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UPDATE REPORT

REDUCTION OF TOXIC CHEMICALS FROM ONTARIO POINT SOURCES DISCHARGING TO THE NIAGARA RIVER 1992

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Ontario

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EXECUTIVE SUMMARY

As part of Ontario's Commitment under the Niagara River Toxics Management Plan (NRTMP) to report on discharges to the Niagara River, this report documents the 1992 toxic chemical loadings from Ontario industrial and municipal point source dischargers to the Niagara River.

Calculations of the reduction in loadings of the 18 Chemicals of Concern for the Niagara River are provided, as are reductions in the 10 chemical parameters targeted for a 50 per cent reduction by 1996. These calculations are based on the NRTMP selection of 1986 as a baseline year.

The total loadings for the 18 Niagara River Chemicals of Concern for 1992 was 2.8 kilograms per day. This is a loading reduction of 79.2 per cent from 1986 to 1992, representing a 62 per cent reduction by industries and an 83 per cent reduction by municipalities.

The total loading of the 10 chemicals targeted for a 50 per cent reduction by 1996 was 0.097 kg/day, representing an overall reduction of 94 per cent for these targeted chemicals. This represents a 91 per cent reduction by industries and a 99.5 per cent reduction by municipalities. Eleven facilities have entirely eliminated these chemicals from their effluent.

INTRODUCTION

In 1981 the Niagara River Toxics Committee (NTRC) was formed to conduct an extensive investigative program to determine the environmental quality of the Niagara River. The committee consisted of representatives from Environment Canada, the Ontario Ministry of the Environment (now the Ontario Ministry of Environment and Energy), the United States Environmental Protection Agency and the New York State Department of Environmental Conservation. The goal of this group was to determine what toxic chemicals were in the Niagara River, identify their sources, recommend activities to control pollution and to establish procedures to monitor the effectiveness of these activities.

In 1984 the NRTC issued its report summarizing the input of priority pollutants and special categories of organic contaminants into the Niagara River. The section which dealt with point sources, industrial and municipal discharges from both the Ontario and New York sides of the river, indicated that point sources contributed a total loading of 1407 kg/day of toxic contaminants to the river. A total of 17 point sources were identified in Ontario, eight of which were found to be "significant", or are equal to or exceed NRTC cut-off levels for at least one parameter. At this time it was determined that the Ontario significant point sources contributed 152.2 kg/day, or 11 per cent of all toxic contaminants entering the river.

On February 4, 1987, a Declaration of Intent was signed by representatives of the four environmental agencies which have jurisdiction along the Niagara River. The goal of the Declaration of Intent was a reduction in the loadings of persistent toxic chemicals of concern into the river. The Declaration of Intent was combined with a workplan to proceed towards this goal. Together these documents form The Niagara River Toxics Management Plan (NRTMP). The 1990 NRTMP update outlines 18 persistent toxics which have been selected for priority attention because they had previously been found at unacceptable levels in the Niagara River/Lake Ontario ecosystem. These are the 18 Chemicals of Concern for the Niagara River. A subset of ten of these chemicals, identified as having a significant Niagara River source, were targeted for a 50 per cent reduction in loadings by 1996, when compared to the selected baseline year of 1986.

A Co-ordination Committee, Secretariat and six technical committees (River Monitoring, Point Sources, Non-point Sources, Categorization, Standards and Criteria and Fate of Toxics) carry out this workplan.

As part of the NRTMP, the Ministry of Environment and Energy shall:

1) By March 1989 produce a report which identifies those point source discharges that contribute one or more of the ten chemicals that are targeted for a 50% reduction by 1996. This report entitled "Priority Toxic Chemicals of Concern from Ontario Point Sources Discharging to the Niagara River 1988" was issued in June 1989.

   - Provide schedules on a facility-specific basis that will ensure that the attainment of the 50% reduction goal for point sources is reached to the full extent possible within existing laws and regulations.

- Identify the technical, legal and regulatory impediments, if any, that may interfere with the attainment of the 50% reduction goal.

2) Recommend how to refine the point source loadings estimates for all priority toxics.

3) By September 1989, prepare a report summarizing progress in reducing the point source loadings of the full range of toxics monitored in municipal and industrial treatment plant effluents (issued December 1989).

With the exception of combined sewer overflows (CSOs), the point sources are also required to participate in Ontario Ministry of Environment and Energy self monitoring programs. The Industrial Monitoring Information System (IMIS) and the Utilities (municipal) Monitoring Information System (UMIS) requires facilities to submit monthly laboratory analytical results of conventional pollutant parameters and some facility specific parameters to the Ministry. Data are provided for both intake and effluent streams. These results are released annually in the "Report on the Industrial Direct Discharges in Ontario" and "Report on the Discharges from Sewage Treatment Plants in Ontario". These reports summarize compliance by the facilities with Ministry requirements under formal abatement programs, Control Orders, Requirements and Direction and Certificates of Approval.

In 1988 a new compulsory program, the Municipal-Industrial Strategy for Abatement (MISA) was established. The goal of this program was the virtual elimination of persistent toxic contaminants from all direct dischargers to Ontario waterways. It would establish an abatement program for major specific toxic pollutants from both industrial and municipal sources. Waste streams for nine sectors of industry were extensively monitored for a year long period. Hazardous pollutants were identified by this monitoring period. These results will then be used to evaluate discharge standards which would be set using a criterion of the best available pollution control technology economically achievable (BATEA).

Current activities undertaken by the Ministry include:

- Reporting annual loadings of all point sources for
  - the 10 chemicals targeted for a 50% reduction
  - the remaining 8 chemicals of concern in the Niagara River

- The inclusion of MISA data in point source loadings calculations

- Reviewing and providing recommended actions on analytical and quality assurance/quality control protocols to be applied in the determination of the chemical loadings to the Niagara River so that a consistent approach may be taken

- Developing a consistent approach and format for reporting all data, including all significant and non-significant point sources.

While this report looks at a snapshot of the river (18 chemicals of concern), it should be noted that over 145 conventional and toxic parameters are monitored for point source discharges to the Niagara River.

SAMPLING PROGRAM

The data obtained and summarized in this report for the Niagara River monitoring program are the result of monitoring by the Ministry between 1986 and 1992. From 1986 to 1989 samples are representative of a 56 hour or 2.3 days per year sampling period. This sampling protocol was based on the recommendations contained in the 1984 Report by the Niagara River Toxics Commission. This sampling period was expanded to two semi-annual 56 hour sampling periods in 1990. In order to obtain a more representative database, and to determine any possible seasonal variations, samples were collected over a 24 hour period, on a monthly basis for the 1991 monitoring year. Sampling for this program is currently conducted on a quarterly basis. The location of the facilities sampled are presented in Figure 1, page 12.

Sampling Methods

The data produced are from samples collected as per the Ministry's *Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater* (a synthesis of the best available information from organizations including the Ontario Ministry of Environment and Energy, Environment Canada, Standard Methods, U.S. Environmental Protection Agency) and reflect, to the greatest extent possible, the chemical, biological and physical properties of the effluent stream studied.

All samples were collected from a location in the wastewater stream which would provide a representative sample. In general, samples were collected at a point of thorough mixing, without excessive turbulence which could cause the loss of volatiles to occur.

Special collection and preservation techniques were required of specific samples in order to ensure the stability of the target compounds during transportation and storage (Appendix F). These measures were taken to assist in the elimination of analytical interference. In order to ensure sample integrity, two sample collection methods were used: grab and composite samples. Grab samples were collected where wastewater characteristics were expected to be relatively constant over 24 hour period and where target chemical parameters were unstable or unique in any of the following ways:

1) Volatile organics and sulphide have a tendency to migrate out of the sample into the surrounding air.

2) Samples for oil and grease analysis are collected directly into the laboratory container, unless direct retrieval is impossible, in order to minimize unavoidable losses during transfer.

3) Samples collected for phenols and cyanide analysis are collected manually (due to the possibility of a reaction with the silicon tubing required in automatic samplers) directly into a precharged laboratory container (i.e. one containing an appropriate amount of test parameter-specific preservative). Clinical testing indicates that significant losses of these compounds occur in the absence of preservation.

Where temporal variability occurs in a wastewater stream, an automated sampler was utilized to obtain a twenty-four hour composite sample.

In order to minimize the possibility of cross contamination, all effluent or liquid contact surfaces of the sampling equipment, their containers, all automated sampler tubing and contact components, were dedicated to a particular sampling location. Similarly, for both manual and composite samples, all surfaces that contact the sample are relatively inert, (being composed of materials which will not contaminate, absorb or adsorb the chemicals to be analyzed in the sample (Teflon, glass or stainless steel)). Short sections of surgical grade silicon rubber tubing are used within the peristaltic pump portion of the autosamplers, as dictated by the design of the pump.

Samples were maintained at a temperature between 10° C and the freezing point, at all times, in order to minimize test parameter degradation or biochemical reaction.

Flow Measurement

Reported flow rates represent a combination of industry/municipality supplied flow measurements and Ministry field measurements. All flow measurements reported for companies involved in the MISA Program, (Atlas Specialty Steels, Canadian Occidental Chemicals, Cyanamid Canada, Niagara and Welland Plants, Geon Canada Ltd.(formerly BFGoodrich), Norton Advanced Ceramics, Washington Mills Electro Minerals Corp. and Washington Mills Ltd.) conform to the protocols and procedures outlined in the MISA General Effluent Monitoring Regulation with respect to calibration, accuracy and maintenance of flow measuring systems. The Ford Motor Company - Niagara Glass Plant utilizes a flow monitoring system which follows MISA protocols, although the facility is not regulated under the MISA Program. The remaining non-MISA regulated industrial facilities (Fleet Industries, Gencorp Canada Inc. and StelPipe Welland Tube) report flows which are estimated using a mass balance based on measured intake flows.

Municipal flow measurements and reporting are not standardized, with the exception of Queenston WPCP, which has accuracy and calibration requirements incorporated into their operating Certificate of Approval (C of A). However, the other municipal facilities are required by their C of As to maintain all their equipment, including flow measuring devices, according to good operating practice.

Analytical Methods

All samples were analyzed according to the sample preparation and instrumental measurement principles listed for each analytical test group in Appendix F.

All analytical instruments underwent periodic multiple point calibration. Daily calibration checks were performed using a suitable reference material to ensure that the instrumentation was functioning within specified control limits. Calibration standards were validated against a standard reference material. A calibration curve was established and confirmed periodically for each analytical procedure within the range normally encountered in samples of the type being analyzed.

Four types of laboratory quality control samples were prepared and analyzed with each analytical run:

1. A method blank sample which is an uncontaminated sample of water which is free of the target parameters and of any substances which may interfere with the analyses. These results are used to establish a baseline response and indicate the presence of contamination in glassware and equipment, and cross contamination from samples containing high concentrations of target parameters or interfering substances. Analytical results are corrected to take into account any positive results of associated method blank sample analyses.

2. A replicate sample which is an additional or second aliquot of a randomly selected sample in the analytical run. Replicate sample analysis provides an indication of within run precision.

3. A spiked blank sample which is a method blank sample to which a known quantity of each target parameter has been added (normally 2 - 5 times the regulation MDL). This provides an indication of the efficiency of the method to recover and accurately quantify target parameters.

4. A spiked sample which is a randomly selected sample within the analytical run, to which a known quantity of each of the target parameter have been added. This will indicate the presence of matrix-specific interferences which may hinder accurate target parameter recovery and quantification.

All data were obtained using the methods outlined in Appendix G. Sample results meet or better the Method Detection Limits (MDLs - the minimum concentration of a substance necessary to infer its presence in a sample with a confidence level greater than 99 per cent) as outlined in Appendix G. Trace values were also reported. Trace values are concentrations which are measurable outside the 99 per cent confidence range, normally within the 95 per cent confidence range.

Pollutant Categories

Contaminants are grouped by priority pollutant categories which reflect their analytical test groups. Individual contaminants and their categories are outlined in Appendix G.

The priority pollutant analytical groupings are defined in the *Handbook of Analytical Methods for Environmental Samples* as follows:

Base/Neutral Extractables

Base/neutral extractables are a diverse group of organic compounds. Niagara River Chemicals of Concern within this group include the polynuclear aromatic hydrocarbons (PAHs) benz(a)anthracene, benzo(a)pyrene benzo(b)fluoranthene, benzo(k)fluoranthene and chrysene.

PAHs are formed during heating, burning, incineration and other combustion processes of many types of carbonaceous materials. Coal, coke, petroleum based fuels and aromatic compounds in general are particularly prone to the production of these compounds under conditions of insufficient oxygen and/or low combustion temperatures. In the presence of air, light and/or heat, some PAH compounds are reported to undergo chemical changes such as dimerization, photodegredation, oxidation etc., particularly when dissolved in solvents or adsorbed onto active surfaces. Hydrocarbons such as benzo(a)pyrene have been found to be carcinogenic.

Metals

The trace metals of interest are those which have a defined toxic threshold and have bioaccumulation potential in the environment. Lead and mercury are Niagara River Chemicals of Concern within this group.

Lead is found in the environment primarily as the mineral galena and in lesser quantities as other mineral forms. These lead bearing minerals are generally insoluble. The majority of lead therefore enters aquatic systems through industrial, mining and corroded piping sources. Lead is used in alloys and solder, batteries, electronic devices, radiation and sound barriers and plumbing. Lead is toxic to the nervous system and may cause permanent brain damage.

Mercury is a trace element in the environment, occurring as an insoluble component of cinnabar ore. Mercury is widely used in thermometers, hydrometers and pyrometers, the extraction of gold and silver from ores, as a reagent in chemical and electroanalysis, pharmaceuticals, pesticides, paints and in dentistry. Mercury is readily alkylated in the environment, resulting in a toxic form which is readily absorbed by skin, producing burns. Alkyl forms also have an affinity for brain tissue and may cause permanent brain damage.

Hydrides

Hydrides are binary compounds of hydrogen and metals. They are poisonous, strong reducing agents which decompose to metal solutions upon heating. Hydrides are used as hydrogenating catalysts in alloy production, electronic component manufacture and in some pesticides. Arsenic is a chemical of concern within this group.

Organochlorine Pesticides and PCBs

The organochlorine pesticides (OCs) form a class of compounds which includes widely used pesticides. Ocs can be classified as halogen derivatives of alicyclic hydrocarbons. Niagara River Chemicals of Concern within this group include PCBs, mirex, chlordane, dieldrin, toxaphene and DDT.

The possibility of environmental contamination by organochlorine pesticides and polychlorinated biphenyls are of particular concern because of their persistence. The stability of these products allows them to persist in the environment almost indefinitely creating a special hazard to wildlife due to the capability of many organisms to concentrate these compounds. This means that low levels (ng/l) of Ocs and PCBs in water can be biomagnified up the foodchain so that fish and fish-eating birds may contain mg/kg levels of these products. PCBs and DDT have been implicated in egg shell thinning in wild birds, endangering survival of some species.

Generally, Ocs are resistant to degradation and oxidation, are relatively insoluble in water, have low volatility and are lipophilic. Similarly, PCBs have low volatility and are relatively insoluble in water, however, they are also resistant to acids, alkalis and high temperatures. PCBs were used in protective coatings, plasticizers, water-proofing compounds, asphalts, inks, casting waxes, adhesives and as dielectrics, hydraulic fluids, grinding fluids and high pressure lubricants.

Ocs can cause nervous and respitory system degeneration and liver and cardiac damage. PCBs produce liver disfunction, reduce haemoglobin through blood tumour formation, reduce reproductive capability in laboratory animals and are believed to be carcinogenic.

Volatile Organics

Volatile organics are a diverse group of water insoluble, chlorinated hydrocarbons which, due to their low molecular weight and high vapour pressure, have a tendency to evaporate. Niagara River Chemicals of Concern within this group are tetrachloroethylene, hexachlorobenzene and octachlorostyrene.

The chlorinated ethylene compounds are a group of solvents used in dry-cleaning and the degreasing of metals. They are strong irritants, narcotics and defatting agents which may cause tissue damage.

The benzene and the chlorinated benzenes are a group of solvents commonly used in the manufacture of medical compounds, lacquers and varnishes, linoleum and leather products. Benzene is acutely toxic causing severe irritation of the mucous membranes, convulsions and respiratory failure. Chronic exposure can lead to bone marrow depression and aplasia and is a listed carcinogen. The chlorinated forms may cause damage to the kidneys and liver as well as cause the depression of the central nervous system.

2,3,7,8-Tetrachlordibenzo-p-dioxin

2,3,7,8-Tetrachlordibenzo-p-dioxin (TCDD) is an organic compound consisting of two benzene rings held together by two oxygen bridges with chlorine substituted for hydrogen at the second,third, seventh and eight positions on the benzene rings. TCDD has no specific use but is a contaminant created in the manufacture of various pesticides, herbicides and chlorophenols (wood preservatives, disinfectantants) or through the incomplete combustion of a variety of organic and inorganic compounds such as in stack and vehicle emissions and forest fires.

Dioxin is not readily soluble in water and readily and strongly sorbs to soils and sediments. It is readily bioaccumulated by a variety of aquatic organisms including fish. It is a potent toxin to terrestrial organisms. Dioxin exposure leads to weight loss and anorexia through extreme liver damage and immune system suppression through thymus destruction. Other effects vary widely with species. Dioxin is suspected to be a carcinogen.

The MISA program monitor for this substance at subject industrial facilities within the Niagara River basin. It has never been detected.

Data Evaluation

Concentration Determination

All data were preliminarily screened for statistical accuracy and were determined to be normally distributed. The significance of outliers, values greater than two standard deviations away from the mean, was determined using the t distribution. Trace concentrations, values below MDLs, are reported by the Ministry's Laboratory Services Branch. Values less than one-tenth of the method detection were assumed to equal zero. Values greater than one-tenth of the MDL were assumed to equal their reported value. Limits of quantification are presented in Appendix H. These methods are consistent with those prescribed by the Ministry's *MISA Monitoring Database Guide*.

Calculation of Loadings

Loadings are reported as either net or total. Net loadings are adjusted for those facilities (Cyanamid - Niagara and Welland, Ford Glass, Geon Canada (formerly BFGoodrich), Norton, and Washington Mills Electro Minerals), who both draw water from and discharge effluent to the Niagara River or its tributaries. For these facilities, the concentration of contaminants in the intake is subtracted from the concentration of contaminants in the effluent. This adjustment is made in order to reflect the actual loading contribution of the facility to the Niagara River system. This adjustment is not made to the remaining facilities since their source of raw water is from outside the Niagara River system, thus making the raw water itself a potential source of contaminants to the Niagara River.

Net loadings were calculated as the product of daily flow and daily effluent concentration minus daily influent concentration for each waste water outfall at a facility. Total loadings (as opposed to net) were calculated as the product of daily flow and daily concentration. Daily loadings were summed for the fiscal monitoring year (April 1 -March 31) and divided by the total number of samples obtained for that parameter, in that year, in order to produce an average parameter loading for that year. Where influent concentrations exceed outfall concentrations, a value of zero is applied to that result. Total loadings are calculated as the sum of all average daily parameter loadings for all points of discharge from a facility. For both net and total loadings, when a trace concentration value is reported as greater than one-tenth the method detection limit, but less than the detection limit, this reported value is accepted and used. Where a reported value is less than one-tenth the method detection limit, a value of zero is applied to the result.

Data Evaluation Considerations

The major limitations with the data produced are related to the frequency and duration of sampling as well as flow measurement.

Between 1986 and 1990 composite samples were collected over three consecutive days, one to six times per year. With automated sampling equipment, composite samples were collected as 8, 24 and 24 hour composites of aliquots taken at 6, 20 and 20 minutes apart respectively. Samples obtained manually represent a five part grab composited over an eight hour period. These grab samples represent effluent quality at the time of sampling only. While compositing tends to integrate temporal fluctuations in effluent quality, due to equipment and staffing constraints, manually composited samples were collected only during daylight hours. Daily variations in effluent quality are not detected by manual composites. Similarly, samples collected only 1 to 10 times per year do not reflect potential seasonal or long term average variations with respect to effluent quality. In 1991 this deficiency in sampling frequency was addressed through an intensive year-long sampling program. Monthly samples were obtained from all process effluent streams as 24 hour composites comprised of aliquots taken every 15 minutes. Intake samples and relatively inaccessible cooling water streams represent a manually composited 3 part grab collected over a 24 hour period.

Long term trends analyses are limited by the spectrum of analyses performed. There are differences in the number of parameters analyzed between 1986 and 1991 due to program changes. For some facilities the full spectrum of parameters was not analyzed until 1991. The omission of certain analytical test groups negatively biases loading calculations by potentially underestimating loadings in those years not all parameters were analyzed. Similarly, analytical limits of quantification were not constant over the study period. As analytical methods improved over time, the lower limits of quantification were also improved. This also results in potentially negatively biased data from earlier monitoring periods. Presently quantifiable results would not have been detected in earlier analyses. The majority of results reported for 1992 were below the MDL. As analytical results approach zero, the statistical confidence level in trace measurements is also reduced. Analyses can never affirm the absence of a compound, they can only affirm the presence of a compound at a given level. Thus, as effluent quality improves and concentrations approach zero, it is difficult to accurately quantify analytical results.

Another variable in the calculation of loadings is flow measurement. There are temporal and method variations in flow measurement that affects both individual facility loadings and interfacility loadings comparisons. Prior to 1989, there were no specific requirements governing flow measurement accuracy. Flow rates were based on daily, monthly or annual averages. Since fluctuations in flow rate affect the calculated loading, the use of averages may represent general trends, but do not account for the specific conditions at the time of sampling. Similarly, the long term facility averages were based on a variety of methods, from estimation using mass balances based on water intake to accurate individual stream measurements, with a corresponding accuracy variance between the methods used. Those companies involved in the MISA monitoring program had these variations standardized, however non-MISA regulated facilities and municipal facilities continue to lack a consistent standard for flow measurement.

In summary, loadings calculations are influenced by:

- the frequency of monitoring
- the accuracy of sample collection
- the accuracy of sample preservation, transport and storage
- the number of parameters analyzed
- the accuracy of the analytical method
- the analytical detectablility of small amounts of contaminants
- the accuracy of the flow measurements

The cumulative effect of variance in analytical detection limits and flow measurement are presented in Appendix I as potential loadings.

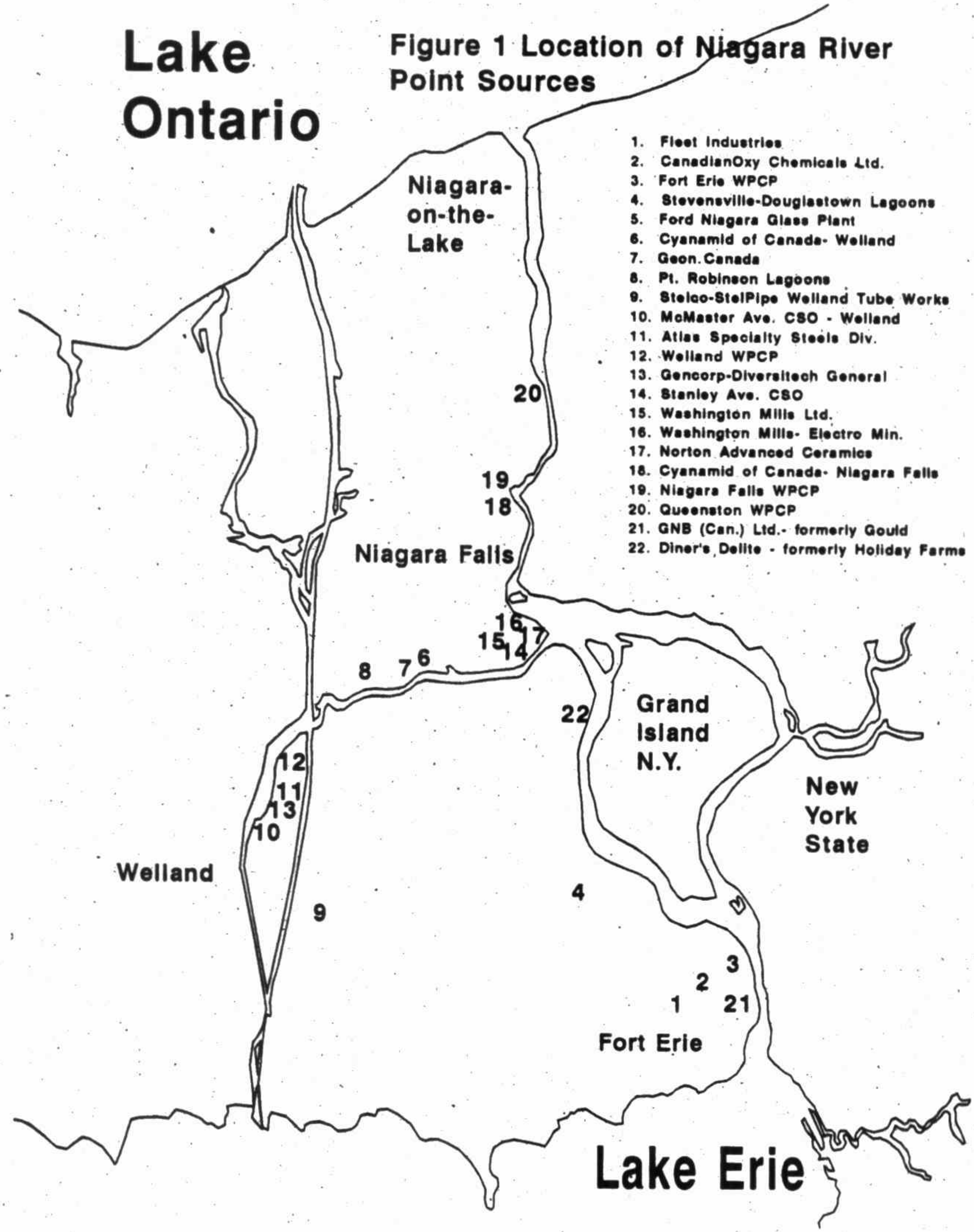
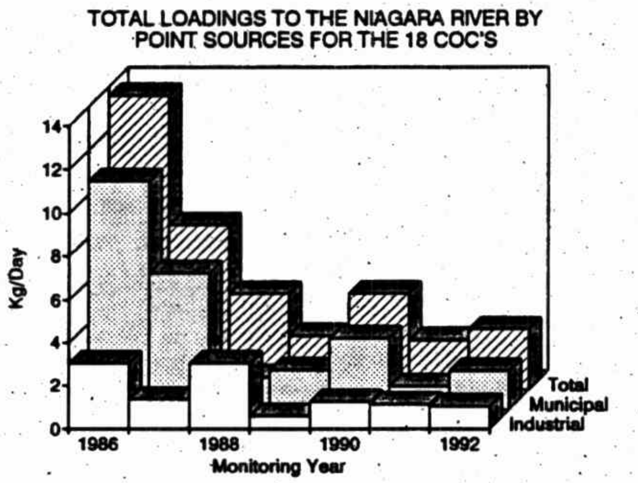
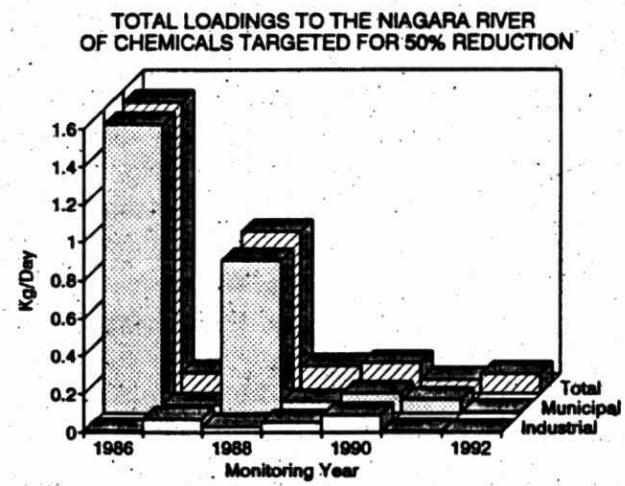


Figure 1 Location of Niagara River Point Sources

SAMPLING RESULTS

General Trends





Loading of the chemicals of concern (COCs) for the Niagara River remained low in the 1992 monitoring year. An overall reduction of 79 per cent was achieved for the 18 chemicals of concern and a 94 per cent reduction was obtained for the chemicals targeted for 50 per cent reduction by 1996 when compared to the 1986 baseline year. While these reductions are 4 and 2 per cent less respectively than 1991, the actual concentrations of contaminants exhibit a continued trend of reduction. This apparent contradiction is the result of trace and background concentrations of contaminants being determined, variable flow rates and a reduced monitoring program. Contaminant concentrations have reached the lowest possible range for quantification. Analytical results were greater than the detection limit in only 6 per cent of the samples for any of the chemicals of concern. Less frequent sampling in 1992 results in a less normalized range of both analytical and flow results. This causes temporal fluctuations not to be integrated, thereby biasing results.

Of the 18 chemicals of concern, three compounds were detected on a consistent basis: arsenic, mercury and lead. While these compounds comprise 96.8 per cent of the total loading, they were determined at trace levels, below the method detection limit, in 78 per cent of all positive analyses.

Arsenic was found only in trace concentrations which were always below the Provincial Water Quality Objective (PWQO). Arsenic comprises 1.3 per cent of the total loading of chemicals of concern and has been reduced 98.6 per cent from 1986 levels.

Mercury represents 0.26 per cent of the total loading of the 18 chemicals of concern to the Niagara River. The 1992 loading of mercury has been reduced 92 per cent from 1986. Mercury was determined at a level exceeding trace quantities once and no facility discharged mercury at a level exceeding PWQOs in 1992.

Lead remains the major component of the loading of the 18 chemicals of concern, comprising 95 per cent of the total loading. Lead levels were 71 per cent lower in 1992 than in 1986 and were found at trace concentrations in 68 per cent of the samples. Concentrations occaissionaly exceeded PWQOs at several facilities.

While tetrachloroethylene comprises 3 per cent of the loading of the chemicals of concern, there is no consistent source of this contaminant. Since 1986 tetrachloroethylene has been an anomalous component of various facilities' effluent. The majority of the 1992 tetrachloroethylene load, 95 per cent, was determined at municipal treatment facilities. The random nature of the tetrachloroethylene determinations and its predominance at municipal treatment facilities, suggest that its main source is occasional handling difficulties at a variety of sources discharging to the municipal sewer system.

Four other compounds, (chrysene, tetrachloroethylene, octachlorostyrene and chlordane) were detected once, at trace concentrations, at various facilities throughout the 1992 monitoring period. This lack of consistency in source and the extremely low levels of detection for these compounds implies that they are anomalies of questionable source and may represent historic deposits of persistent chemicals.

Atlas Specialty Steels

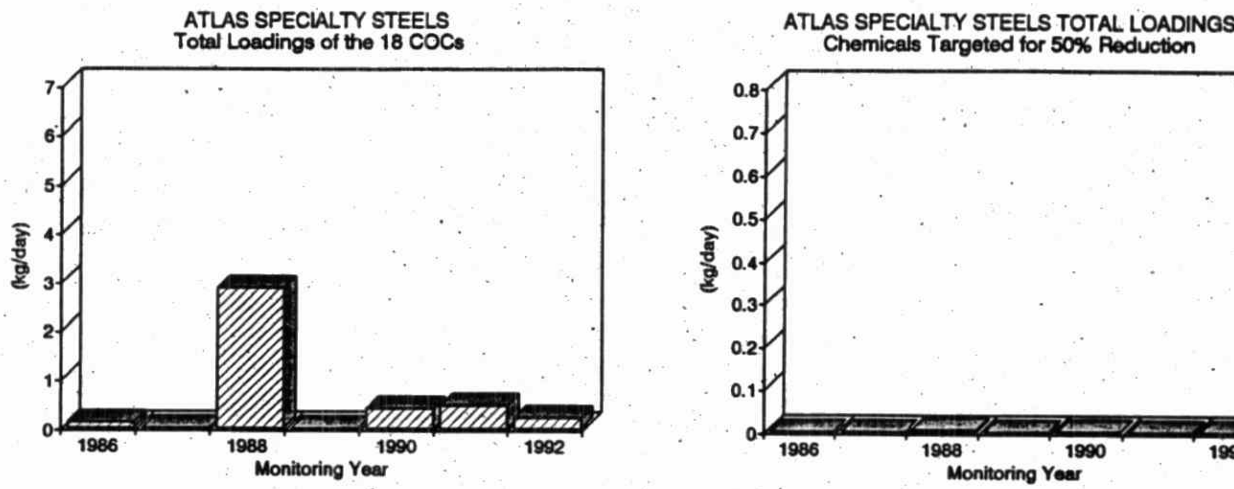


Fig. 3: Proportional loadings of the Chemicals of Concern by Atlas Specialty Steels

Atlas Specialty Steels is located in Welland, Ontario, adjacent to the Welland River. The plant produces specialty grade steels including stainless, carbon, low and high alloy, tool, machinery and mining steels in billet and ingot form.

Electric arc furnaces are used to melt scrap metal. The steel melt is refined and continually cast or poured into ingots prior to hot rolling operations. Following the hot rolling process, the steel may undergo heat treating, machining or cold finishing.

Atlas uses water from the Old Welland Canal and potable water from the City of Welland for process and cooling purposes. Canal cooling water is recirculated, temperature permitting.

Process effluents are treated at a Waste Acid Solidification Plant (WASP) and two filter treatment plants (north and south).

The WASP was installed for the purposes of disposing of a portion of the Electric Arc Furnace bag house dust, neutralizing waste pickling acids and neutralizing salt bath descaling and pickling rinse waters. Lime is added to the waste acids for neutralization and to precipitate metals as hydroxides and silicates. The WASP discharges a volume of 52 m^3 per day to the North Treatment Plant.

The North Plant water treatment system consists of a collection sump, lagoon equipped with oil skimmer and a gravity-sand-anthracite filter system. Polymer is added at the collection sump to aid in the settling of solids. Effluent from the lagoon is either returned to the plant's water distribution system or discharged to the Welland River by gravity through a 42" sewer. Treated effluent is discharged at a rate of approximately 15 600 m^3 per day.

The South Plant water treatment system is similar to that of the North Plant, except that there is no lagoon preceding the gravity sand filters. The South Plant effluent is returned to the water distribution system. The two wastewater filtration/reclamation facilities are credited with reducing total plant water consumption by 27% through increased recirculation.

Current total loadings for Atlas Steels are presented in Figure 3 and Table 4. Lead remains the dominant contaminant in Atlas' loadings, comprising the entire loading from the facility in 1992. Effluent concentrations of lead have shown considerable variability and have been declining since 1988. In 1992 lead was found at a concentration greater than trace levels only once. Arsenic and mercury were previously detected sporadically, but frequency and concentration of these compounds have been declining and were entirely absent in 1992. This variability in effluent quality is attributable to the quality of the scrap metal used in production. Residual contaminants are released from the scrap during melting. No chemicals scheduled for 50 per cent reduction were determined in the facility's effluent.

CanadianOxy Chemicals Ltd., Thermoset Division

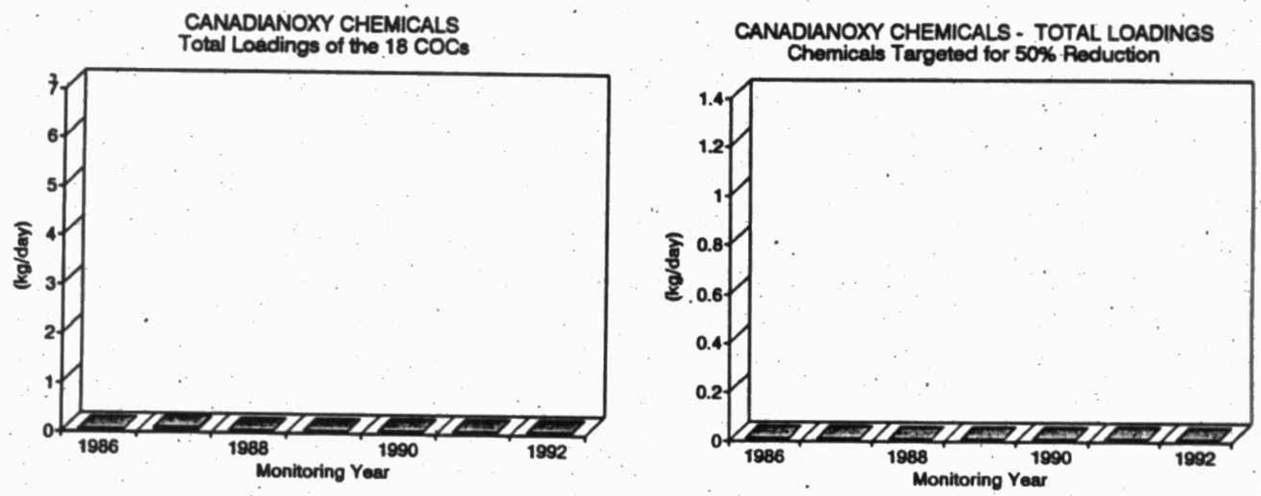


Fig. 4: Proportional Loadings of the Chemicals of Concern for CanadianOxy Chemicals.

CanadianOxy Chemicals Ltd., Durez Division, is a part of Canadian Occidental Petroleum Ltd. and is located on Dunlop Street in the Town of Fort Erie. The company manufactures phenol-formaldehyde (P/F) resins, moulding compounds, furfuryl alcohol-formaldehyde resins and ethylene bis-stearamide wax in semi-continuous batches.

Raw materials used in P/F resins include nonyl phenol, phenol, cresol, formaldehyde and catalysts. The resins produced are used as binders in automotive products and for the manufacture of moulding products. Furfuryl alcohol, formaldehyde and furfuraldehyde are used to produce the furan resins used in the manufacture of coatings and insulation.

Intake water is obtained at a rate of approximately 50 m^3 per day from the Town of Fort Erie.

Water used for reaction in the P/F kettles is distilled off. This highly contaminated phenol-bearing distillate is stored on-site prior to being shipped off-site for phenol recovery or disposal. All other processes are dry.

Cooling water from the P/F resin area is recycled through cooling towers. The cooling water from the resin flaker belt, which was a major source of phenol contamination from the plant, was closed-looped in February 1989, thus eliminating this loading of phenols to the river. The remaining miscellaneous non-contact cooling water from other areas of the plant and storm water drainage is discharged, without treatment, through a single outfall to Frenchman's Creek at a rate of 65 m^3 per day.

Total 1992 loadings for CanadianOxy Chemicals are presented in Table 5. The facility has achieved an 84 per cent reduction loadings of the chemicals of concern since 1986. This reduction is attributable to CanadianOxy eliminating mercury and arsenic from their wastewater stream (Appendix C). Arsenic and mercury are not components of any of the raw materials used by CanadianOxy, so it is likely that the source of compounds was contaminated runoff. By 1989 CanadianOxy had isolated it wastewater discharge from surface drainage inputs. Lead was the only chemical of concern found in this facility's effluent in 1992 and was found in only trace concentrations. None of the chemicals targeted for 50 per cent reduction by 1996 were determined at this facility.

In 1993 CanadianOxy close-looped their remaining outfall, thereby eliminating CanadianOxy as a point source discharger to the Niagara River drainage system.

Cyanamid Canada Inc., Niagara Plant

Cyanamid Canada's Niagara Plant is located on 4th Avenue in the City of Niagara Falls. It manufactured calcium carbide, calcium cyanide, calcium cyanamide and desulphurization polymers.

Calcium carbide is made by reacting coke with lime in an electric arc furnace at a temperature of 2000° to 2200° C. Calcium cyanamide is formed from the reaction of calcium carbide with nitrogen and small quantities of fluorspar. By-products formed from these processes include carbon monoxide, oxygen, calcium and carbonate sludge. Desulphurizing reagents are formed from the blending of diamide lime with calcium carbide.

Calcium carbide is used in the steel industry for desulphurizing steel, in the generation of acetylene and as an intermediate in the production of calcium cyanide. Calcium cyanide is used in the refining of gold.

Intake water for the facility was pumped from the Queenston-Chippawa Power Canal at a rate of approximately 26 450 m^3 per day.

Water use was mainly for the cooling jackets of the arc furnaces and transformer cables. Approximately half of all cooling water was discharged directly back into the power canal, while the remainder was sent to a cooling pond where it was reused for cooling purposes within the plant. Overflow from the cooling pond continuously discharges to Whitty's Creek, a very small tributary of the Niagara River. Contamination of cooling water within the plant occurred from spills of raw materials and product into storm drains which discharged directly to the cooling water channels.

Total loadings for 1986-1991 from Cyanamid Canada's Niagara Plant are presented in Table 6.

This facility was mothballed in March 1992 thereby eliminating all point source discharges from this site.

Cyanamid Canada Inc., Welland Plant

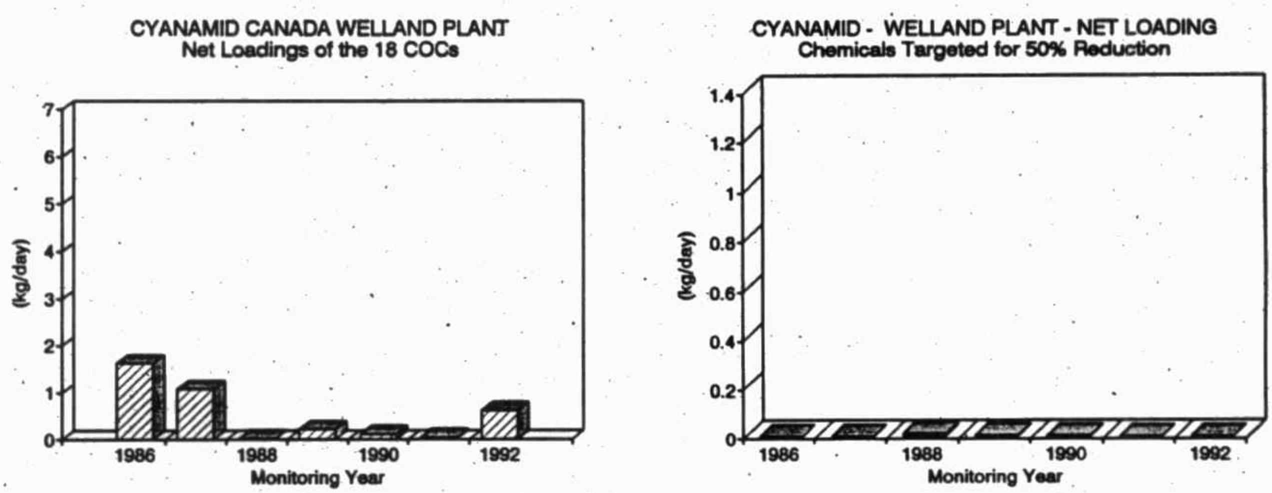


Fig. 6: Proportional loadings of the Chemicals of Concern for Cyanamid - Welland.

Cyanamid Canada's Welland Plant is located at the western boundary of the City of Welland and the City of Niagara Falls. This facility manufactures ammonia, 50% cyanamide solutions, phosphine and phosphine derivatives and electronic grade chemicals. Prior to April 1992 nitrogen-based fertilizers were also manufactured at this facility.

Ammonia is manufactured by the reaction of hydrogen gas with nitrogen over a catalyst at elevated temperatures and pressures. Natural gas is reformed at high temperatures to supply hydrogen while nitrogen is supplied from the air. Carbon dioxide is formed as a by-product.

Phosphine gas is produced when yellow phosphorus is heated with steam in a reactor. Phosphine is further reacted to produce phosphine derivatives.

Intake water is pumped from the Welland River at a rate of 28 800 m^3 per day.

Waste waters are generated from boiler, compressor, cooling tower and steam plant blowdowns. Waste water also originates from once-through cooling water streams, barometrie condensers and a sludge pond. All process units discharge to Millers Creek, a tributary of the Welland River. There is an active sludge pond on site which receives waste sludge material from the phosphine and dicyanamide plants.

The final discharge from this facility was subject to sudden pH and specific conductance fluctuations. Cyanamid has since installed an equalization pond upstream of its final sampling location in order to reduce these occurrences. A major source of heavy metals has since been eliminated with the discontinuation of the use of chromium in the cooling tower.

1992 loadings for this facility are presented in Appendix C. Arsenic and lead remain the only two chemicals of concern to be determined in this facility's effluent. Arsenic is only found at trace levels, and lead concentrations only exceeded trace levels on one occasion. Despite the low concentration of contaminants observed, loadings for this facility increased due to elevated flow rates observed during 1992 monitoring periods.

Diner's Delight

Diner's Delight, formerly Holiday Farms, is a medium sized food processing operation specializing in the preparation of pre-cooked frozen dinners such as prepared meats, stews, lasagna and cabbage rolls.

No slaughtering operations are conducted at the facility. Meat and poultry products are purchased in bulk and delivered to the plant in refrigerated transport trucks. Other foodstuffs used in their production line include cabbage, pasta, rice, flour and spices. Cooking oil is used for their frying operation. The major processing operations include food preparation, cooking and packaging.

Intake water is obtained from the Chippawa Channel and is treated prior to circulation within the plant. Treatment consists of flocculation with alum, filtration, chlorination and carbon filtration to remove taste, odour and any residual chlorine.

Process water is generated through cooking water, poultry defrosting water, product cooling water and cleaning water, Equipment lines are cleaned daily. Floors are rinsed daily using high pressure hoses and washed monthly with detergent and bleach. Other process-related water uses include boiler feedwater and cooling water for various compressors and refrigeration units. All process waters flow via floor drains to a common sump. From this sump wastewater is directed to two vertical grease separators and an aerated primary settling tank. Prior to 1986, effluent from the settling tank was chlorinated and allowed to flow by gravity through a submerged outfall to the Niagara River. However, effluent from the settling tank has been spray irrigated back onto plant property since 1986, thereby eliminating this facility as a Niagara River point source.

Fleet Industries - A division of RONYX Corp. LTD.

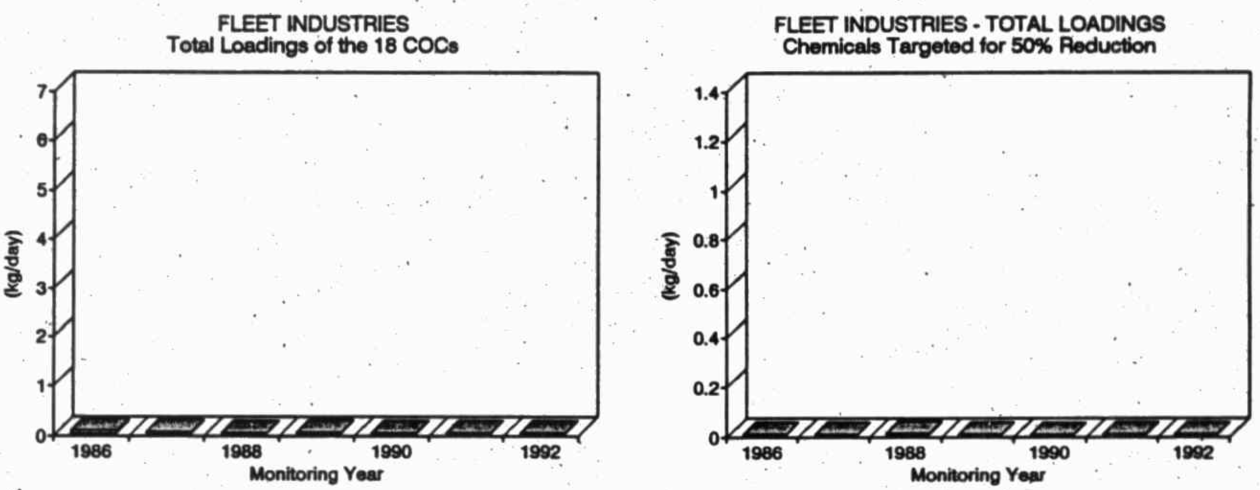


Fig. 7: Proportional loadings of the Chemicals of Concern for Fleet Industries.

The Fleet Division of Ronyx is located on Gillmore Road in Fort Erie. Fleet manufactures airplane and satellite components as well as sonar and radar assemblies.

Raw materials include aluminum sheet and machined parts, stainless steel, fibreglass, phenolic and other resins, sheet plastics (mylar, kevlar etc.) and a variety of paints, primers and lacquers. Materials used in the process operations include organic solvents such as trichloroethylene, ketones, alcohols and xylene; nitric, phosphoric, sulphuric hydrofluoric, acetic and oxalic acid;

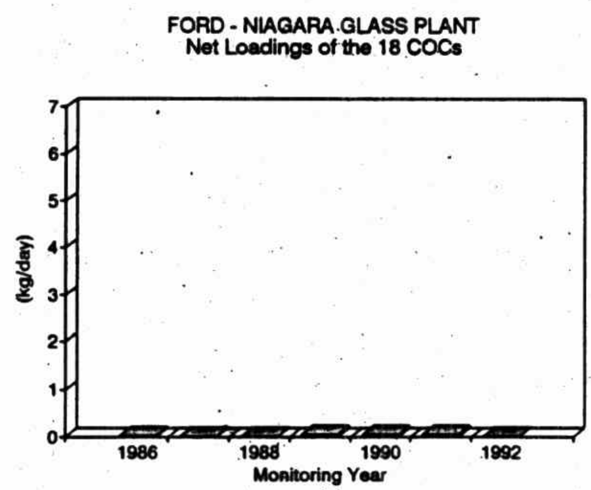
plating solutions including chromic solution, barium chloride and lead nitrate; salt baths (sodium and potassium nitrate) and a variety of solutions such as dyes and dye penetrants.

Process operations include machining, degreasing, bonding, autoclaving metal parts for finishing and primer application. Metal surfaces are prepared for painting and/or bonding by anodizing, chemical cleaning, degreasing and/or chemical etching. The bonding operation is carried out by an adhesive film being placed between the surfaces to be bonded which are then vacuum sealed in a mylar bag. These parts are then autoclaved (exposed to elevated temperatures and pressures). Finishing operations include painting and the application of a protective coating.

Intake water is from the Town of Fort Erie. Water usage includes boiler feed water make-up, cooling water, dilution water for acids, plating solutions and salt baths, spray painting booth recirculation water and wash water.

All process effluents have been segregated and currently discharge to the municipal sewer system. Prior to this segregation, the combined effluent resulted in a high loading of chromium to Frenchman's Creek. However, waste stream segregation and discharges to the municipal sewer system have greatly diminished this loading. Current point source loadings consist of wash water, cooling water and overspill effluents discharged at a rate of 200 m^3 per day. These are collected in a primary and secondary ditch which flow off-site via a culvert under Gillmore Road into Frenchman's Creek, a tributary of the Niagara River. Fleet reduced its loading of the chemicals of concern by 95.8 per cent between 1986 and 1992 (Table 8). Decreased metals concentrations are responsible for this reduction (Appendix C) . Mercury, the only chemical scheduled for a 50 per cent reduction by 1996 to be detected in 1992, was reduced by 98.8 per cent by 1992.

Ford Motor Company - Niagara Glass Plant



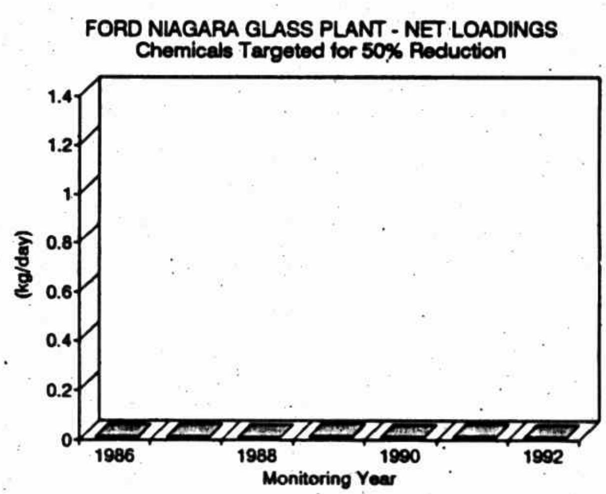


Fig. 8: Proportional for the 18 Chemicals of Concern for Ford Glass

The Ford Niagara Glass Plant is located in Niagara Falls Ontario, just south of the Welland River. This facility manufactures automobile and truck windshields, rear windows and body glass.

Raw materials include float glass and polyvinylbutyral resin (laminate). Major process operations include cutting, seaming, edge grinding and laminating. There are several detergent wash and rinse procedures between stages in the process. Other materials used in the manufacturing operations include cutting oil, grinding coolant, detergent, calcium carbonate powder and autoclave oil. Xylene and silver paste are periodically used in the installation process for rear window defoggers.

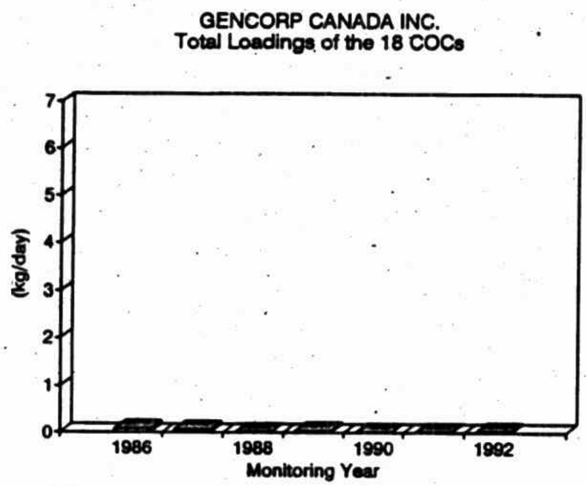
Process water for the plant is supplied by the Welland River and is treated on-site prior to distribution to the various process operations. Treatment consists of flocculation/coagulation with alum, clarification, filtration and chlorination.

Waste water is generated on a continual basis as non-contact cooling water. Intermittent flows include weekly batch discharges of coolant tanks, wash baths and rinse tank overflows. All wastewater is routed to one of two process effluent treatment lagoons. Clarifier sludge generated by the intake water treatment system is also directed to these lagoons. All treated effluent is discharged to the Welland River, 0.75 km upstream of its confluence with the headwaters of the Chippawa Power Canal at a rate of approximately 1 750 m^3 per day.

Loadings for this facility are presented in Table 9. None of the chemicals of concern detected exceeded trace concentrations. Lead comprises 97 per cent of the chemicals of concern loading. Mercury, tetrachloroethylene and hexachlorobenzene were each determined on a single, independent sampling. These latter contaminants were reduced by 73 per cent in 1992 and are all contaminants scheduled for a 50 per cent reduction by 1996.

This facility is scheduled to be closed late in March 1994, eliminating it as a point source discharger. The site is currently being evaluated with respect to decommissioning requirements.

Gencorp Canada Inc.



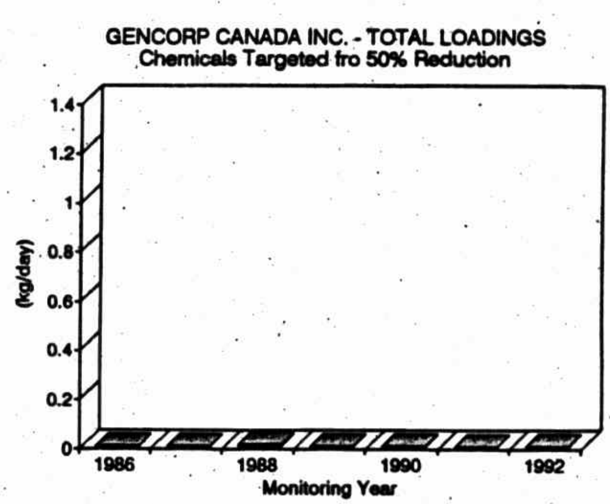


Fig. 9: Proportional loadings of the Chemicals of Concerns for Gencorp Canada Inc.

Gencorp Canada Inc. is located in Welland, just west of Atlas Steels. This facility manufactures rubber automotive trim (windshield edging, trunk seals, windframe guides door seals etc.) and anti-vibration pieces (brushings for shock absorbers and motor mounts). A small line of sporting goods, including NHL hockey pucks and bowling balls, were formerly manufactured on an occasional basis.

Raw materials include natural and synthetic rubber and a variety of chemical agents, including pigments, curing agents and extrusion oils. The exact mix of ingredients is dependent upon the application of final product and the process necessary to form that product. In general, rubber and chemicals are blended in three large mixers, according to the type of material being produced. These mixtures are then fed into extruders and injected into moulds under high temperatures and pressures in order to obtain the desired shape and to provide preliminary curing. Further curing, required by some products, involves either hot air curing or a hot concentrated salt bath (usually sodium nitrate). The salt bath extrusion lines include a final steam and water washing step to clear any residual salt from the product. Following curing, excess material is removed from the product and gluing to the appropriate frames is performed using an isocyanate-based glue. Other processing includes metal part preparation (zinc phosphating) and degreasing using organic solvents such as 1,1,1-trichloroethane.

Intake water is supplied by the City of Welland at a rate of 0.9 to 1.0 million gallons per day.

The majority of wastewater generated is once-through and non-contact cooling water. No wastewater treatment is performed on site. Wastewater from boilers and the zinc phosphating process is discharged to a sanitary sewer leading to the Welland WPCP while all other wastewater is discharged to the Atlas Steel 42" sewer which discharges to the Welland River.

Gencorp's loadings are presented in Table 10. Arsenic and mercury were eliminated from the effluent in 1992. Lead, chlorinated solvents, and pesticides were determined in the effluent from this facility in 1992. Lead forms the vast majority, 98 per cent, of this facility's loading of the chemicals of concern. Gencorp has never used pesticides at this site. Dieldrin and chlordane were detected in trace quantities in 1992, were discontinued for use by Agriculture Canada in December 1990. Thus, the continued detection of pesticides is the result of a historic contamination of the facility's clay brick sewer system. The facility has a 77 per cent reduction in toxics loadings, and a 90 per cent reduction in the chemicals targeted for a 50 per cent reduction by 1996. These reductions have been obtained through greatly reduced metals loadings.

Geon Canada Inc. (Formerly B.F. Goodrich)

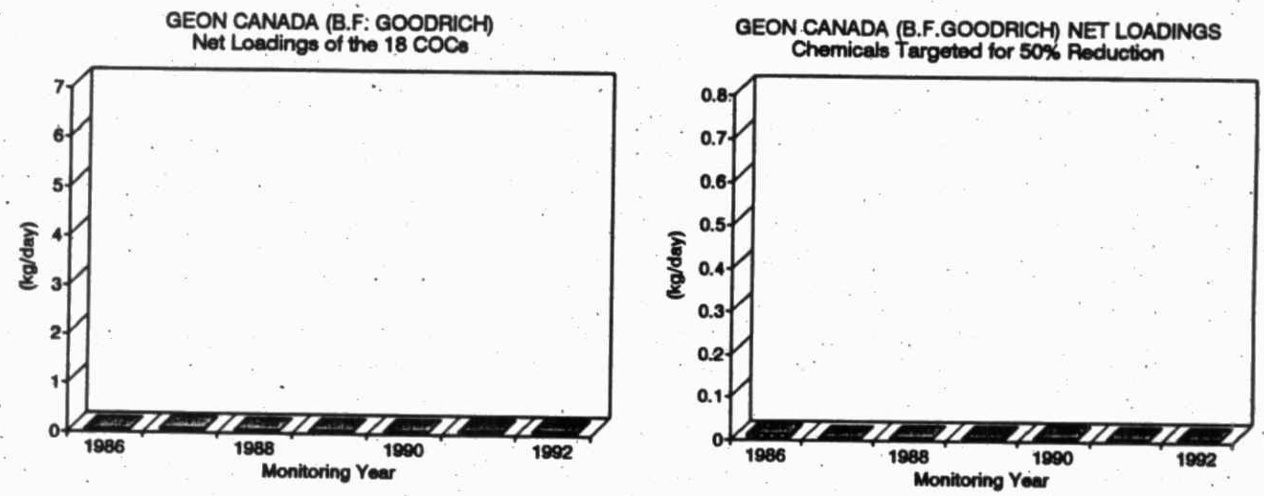


Fig. 10: Proportional loadings of the Chemicals of Concern for Geon Canada.

Geon Canada Inc. (formerly B.F. Goodrich) is located on Thorold Townline Road in Thorold. The plant manufactures polyvinyl chloride (PVC) and PVC/polyvinyl acetate resins from monomers. These resins are used in the manufacture of clothing, automobile trim, piping, wire insulation, window frames, swimming pool liners and siding for houses.

Intake water for the plant is pumped from the Welland River. The site makes use of cooling towers to reduce fresh cooling water inputs. Blowdown is routed through the biological treatment plant prior to recirculation. Total effluent discharged is approximately 2 500 m^3 per day.

Until the summer of 1988, two distinct processes were used in production, emulsion and suspension polymerization. The emulsion process is the older of the two processes. It resulted in greater wastewater generation due to the inherent nature of the process. Wastewater from the emulsion process was steam stripped in three tanks prior to biological treatment. The treated effluent was then routed to an aeration pond, followed by a polishing lagoon prior to discharge into the Welland River.

In June 1990 a facility for compounding PVC with plasticizers and stabilizers was opened. Both PVC resin and cubes of compound began production under this method. The suspension unit process uses a distillation column to recover vinyl chloride monomer before the wastewater is discharged to the common aeration pond and polishing lagoon.

Waste PVC and thickened secondary treatment sludge were dewatered in a reclaim pond equipped with underdrains. The resulting leachate was directed to a valved-off leachate pond which was batch discharged to the Welland River every 1 to 2 months.

The old emulsion process was phased out in November 1991 with the full commissioning of the new suspension polymerization plant. Coinciding with this process change was an upgrading of the on-site wastewater treatment system. The stabilization ponds were removed and replaced with two equalization basins. Biological treatment was increased to two activated sludge units followed by a secondary clarifier. Tertiary treatment was added in the form of a gravity sand filter system. A vacuum filter was also installed for the sludges generated by the primary and secondary clarifiers. The resulting supernatant is now routed back to the treatment system while the filter cake is disposed of off-site.

Loadings for this facility are presented in Table 11. Trace amounts of mercury and lead were determined. Concentrations of these compounds are at the threshold of quantification. Mercury is the only chemical targeted for 50 per cent reduction to be determined in Geon's effluent. Geon has reduced their loading of mercury by 96.8 per cent between 1986 and 1992 and has reduced its total loading of the 18 chemicals of concern by 96.9 per cent.

Gould Manufacturing of Canada Ltd. - Battery Division

Gould Manufacturing of Canada Limited (Gould National Battery or GNB) is located on Lewis Street in Fort Erie, approximately 1 km north of the Niagara River. Gould manufactures lead-acid storage batteries for industrial applications such as lift trucks, aircraft, railway and mining equipment.

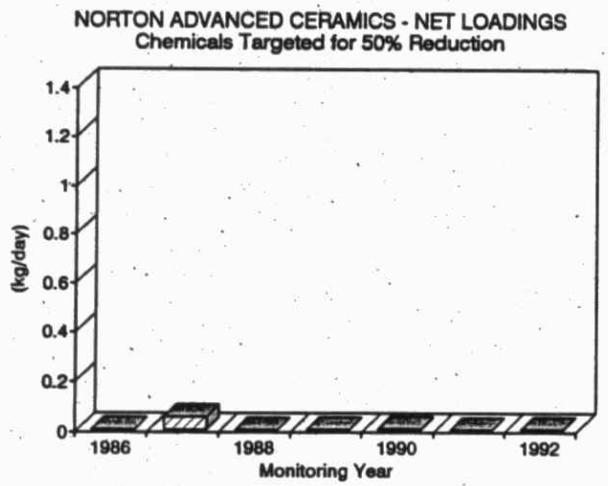
Raw materials include lead, lead-antimony and lead-calcium mixtures, lead oxide powder, water, sulphuric acid, fibreglass wrapping and battery cases.

Battery plates are formed by casting molten lead/antimony or lead/calcium alloys (antimony and calcium are used as hardening agents). Once cast, some plates are trimmed while other are punched into their final shape. Trimmings and scraps from these operations are returned to the melting furnaces. The plates are then coated with a lead oxide paste (lead oxide powder, water and sulphuric acid) and cured in a humidity and temperature controlled oven. At this point most of the plates enter a wet-charging process involving a wet dipping (to prevent lead entering the workplace air), wrapping, and charging with sulphuric acid. The remaining plates are dry charged in one of two ovens. The negatives are dried in a steam drying oven (superheated steam is used to prevent oxygen contact with the negative plates) while the positive plates enter a gas-fired drying oven. The plates are then wrapped and made into cells. The wrapped and charged cells (both wet and dry) are now ready for final finishing.

Intake water is from the Town of Fort Erie municipal water supply. Process water is generated primarily from wash water and cooling water in the battery disassembly, casting and charge cycle areas. Wash water from the plate pasting area had been discharged and contained a high level of lead (Table 12 and Appendix C), but is now on a closed-loop recycle system. Wash water from the process areas undergoes neutralization and settling prior to discharge to an open storm line connecting to Frenchman's Creek, a tributary of the Niagara River, at a rate of 60 m^3 per day.

In 1987 GNB eliminated its discharge to Frenchman's Creek and directed its effluent to the Fort Erie WPCP. Additionally, due to the contamination of the stream bed which conveyed their effluent, Gould has completed a remediation of lead contaminated sediment in order to prevent this sediment from reaching the Niagara River.

Norton Advanced Ceramics of Canada Ltd.



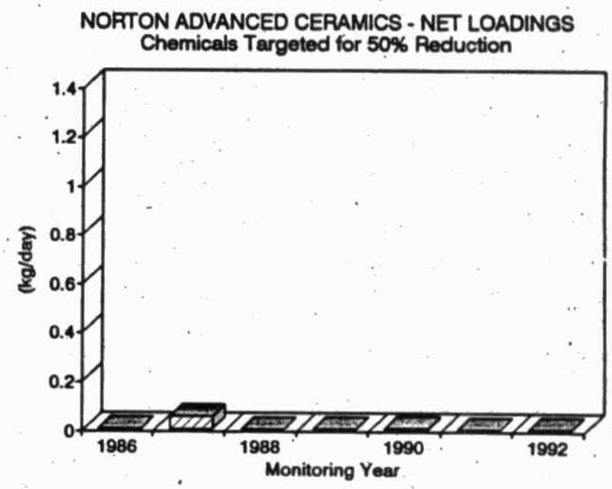


Fig. 12: Proportion loadings of the Chemicals of Concern for Norton Advanced Ceramics.

The Norton Company is located in Chippawa, on the north bank of Chippawa Creek. The plant manufactures various types of abrasive grains including aluminum oxide, dark aluminum oxide and alumina-zirconia. Chromic oxide is also produced on an infrequent basis.

Dark aluminum oxide is formed by fusing bauxite, coke, and iron borings. The solid aluminum oxide is then crushed and ground prior to shipment as a granular product. Light aluminum oxide, which is a higher grade product, has sulphur added during the reduction process in an electric arc furnace.

The light aluminum oxide is poured into ingots and crushed. The grains are acid slaked and washed with water to remove iron impurities. The grains are then dried and sent for magnetic impurities removal.

In a separate process, calcined alumina is received on site and fused in a furnace. The melt is formed into ingots and is then broken or crushed prior to shipment as a more refined product. Alumina-zirconia is manufactured by fusing calcined alumina, baddelyite (zirconia), coke and recycled fines. The melt is solidified and crushed to produce a very tough abrasive grain material.

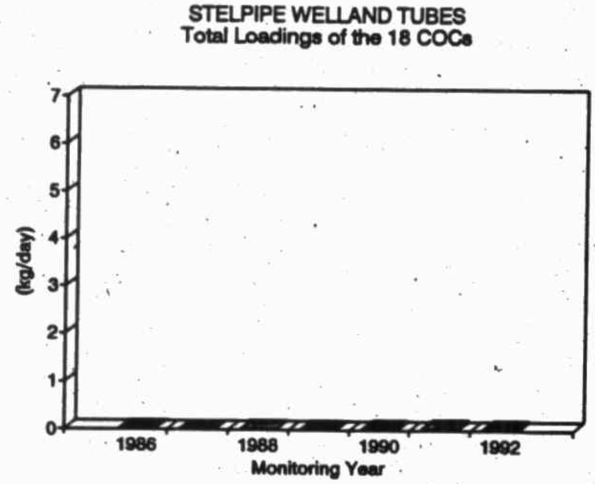
Chromic acid was infrequently produced in batch units. Tri-valent chromium oxide is melted and formed into ingots to produce a purer product which is shipped after particle size reduction.

Intake water is pumped from the Welland River at a rate of approximately 14 200 m^3 per day.

The company has two final discharges which discharge to Pell Creek, one from process areas and one stormwater outfall. Waste waters are generated as cooling water for furnace shells, power transformers and for the cooling of molds. Wash water from the light aluminum oxide process is neutralized with lime and sent to a 4.5 million gallon settling lagoon for solids removal. The discharge from this lagoon is then gravity fed into a sewer for final discharge to Pell Creek.

Loadings for this facility are presented in Table 13. In 1992 Norton has achieved a 97 per cent reduction in loadings of the chemicals of concern. Concentrations of lead have declined 88 % since 1986 (Appendix C). Of the chemicals targeted for 50 per cent reduction by 1996, Norton has eliminated all but mercury from its effluent. Mercury is found sporadically in trace concentrations and its loading has been reduced 98.8 per cent since 1986.

StelPipe - Welland Tube Works



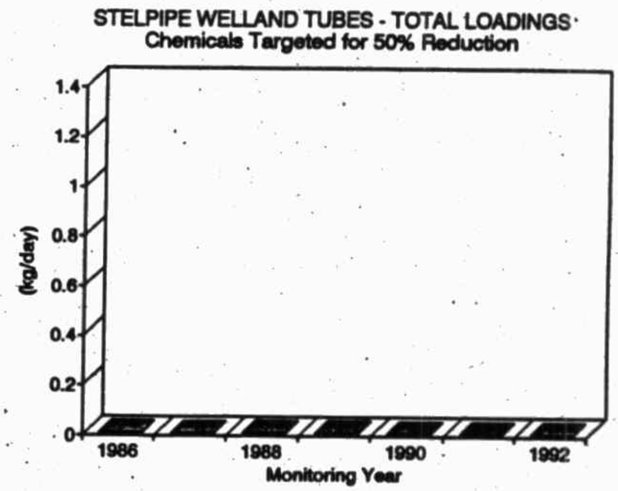


Fig. 13: Proportional loadings of the Chemical of Concern for StelPipe.

The Welland Tube works of Stelco Inc. is located in Welland, just east of the Welland Ship Canal. Two plants are situated here, both manufacturing 20 to 60 inch diameter pipe.

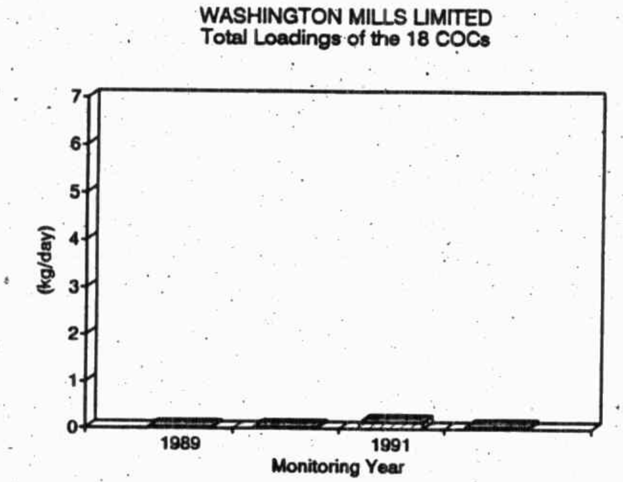
The older of the two plants uses submerged arc welding to produce 20 to 36 inch outside diameter pipe. The newer plant produces spirally formed welded pipe of 36 to 60 inch outside diameter.

Steel plate is brought to the facility from other sources and is formed, welded and rust-proofed on site. Materials used in this process include welding flux, trichloroethane (degreaser), toluene (paint solvent) and paints for the finishing of the tubes.

Intake water is taken from the Welland Ship Canal. This water is used for pressure sizing, hydrostatic testing of finished pipe and rinsing in preparation for painting. Silver bromide is also discharged from photographic processing of x-ray films used to quality assure the welds on the tubes. Process water passes through an API oil water separator and one of two settling lagoons prior to discharging to Lyons Creek, a tributary of the Welland River. These lagoons are also used to treat on-site storm water. Effluent flow is approximately 1 300 m^3 per day at full operation.

Loadings for this facility are presented in Table 14. Small amounts of lead were detected at this facility in 1992. (Appendix C).

Washington Mills Ltd.



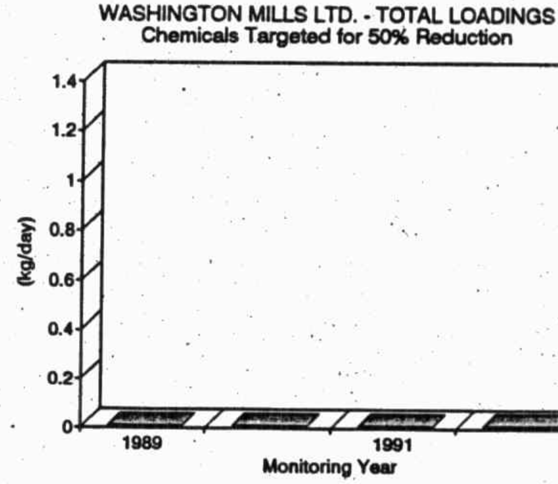


Fig. 14: Proportional loadings of the 18 Chemicals of Concern for Washington Mills Ltd.

Washington Mills Ltd. is located in the south end of the City of Niagara Falls Ontario. This facility manufactures aluminum oxide abrasive grains, ferro-silicon (a by-product) and crude aluminum oxide. Both aluminum products are manufactured in an electric arc furnace where bauxite, coke and iron fillings are fused together to give aluminum oxide melt. This melt is poured into cooling pots for solidification. The solid material is then broken down to produce the final product grains.

Intake water was supplied by an on-site well at a rate of approximately 1630 m^3 per day. In 1992 the facility derived its intake water from the City of Niagara Falls.

Water is used for cooling the furnace shell and melt pots. The spent cooling water is collected in open channels where it flows to a cooling pond for solids settling and aeration. This water is partially recirculated into the process. A separate closed cooling water system is provided for cooling the furnace transformer and cables.

There is a single effluent discharge which drains to the Welland River. Storm water from this facility is collected in catch basins and combined with the cooling pond discharge effluent prior to final discharge. Storm water is also discharged separately into Chippawa Creek at a location downstream of the combined effluent location.

Loadings for this facility are presented in Table 15. Of the 18 chemicals of concern, only metals have been found in the company's effluent, with lead being the primary contaminant. The concentrations of lead observed may be attributable to dissolved weathered material near the outfall or with suspended sediments. Lead concentrations were significantly reduced in 1992, being found at trace concentrations exclusively (Appendix C). Similarly, a single trace determination of mercury was made in 1992. While this result is considered anomalous to the facility's effluent, it will be monitored to ensure it does not become problematic.

Washington Mills Electro Minerals Canada Inc.

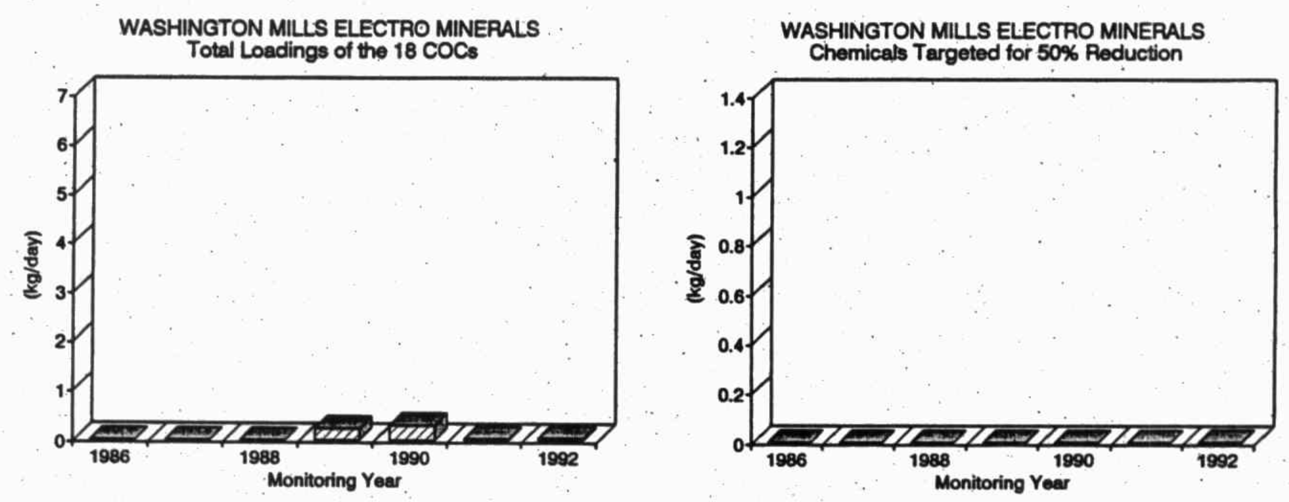


Fig. 15: Proportional loadings of the Chemicals of Concern for Washington Mills Electro.

Washington Mills Electro Minerals is located on Stanley Avenue in south Niagara Falls. The plant manufactures various grades of abrasive metallic rods including brown alumina, pink alumina, alumina bubbles, ferro-silicon, fused mag-chrome and ferro-carbo briquettes.

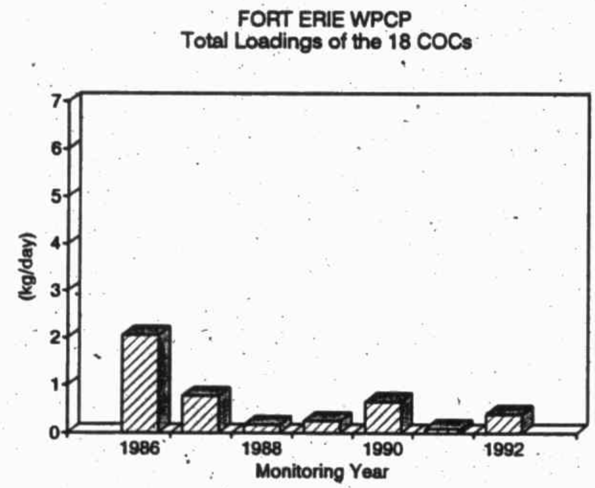
All products are produced by similar processes, differing only by the starting raw materials. All raw materials are weighed and fed into a furnace in definite proportions where they are fused together and then poured into molds for cooling. The cooled solid material is then crushed, sorted and screened to yield the final product. Major raw materials include bauxite, coke, iron borings, white alumina, chromic oxide, ferro-silicon, magnesite and chrome ore.

Intake water is pumped from the Welland River. The facility has two combined effluent discharges, one of which flows into the Stanley Avenue Combined Sewer, the other to Pell Creek. The total effluent discharge is approximately 15 100 m^3 per day.

Process water consists of contaminated cooling water from furnace heads and power transformers. Wastewater is sent to one of two lagoons. The major portion flows to a lagoon for solids reduction and oil and grease removal. Water from this lagoon is partially recirculated, with the remainder being discharged to Pell Creek. Another lagoon accepts wastewater from the left side of the plant and discharges into the Stanley CSO. Storm water from the site is discharged from several locations into the Stanley CSO and from one location directly into Pell Creek.

Loadings for this facility are presented in Table 16. Like Washington Mills Ltd., lead is the sole chemical of concern to be consistently determined in the facility's effluent and was found at trace levels in 1992 (Appendix C). A single trace determination of benzo(k)fluoranthene was also made in 1992. This compound has never previously been found in this facility's effluent and was probably the result of contaminated surface runoff.

Fort Erie (ANGER AVE) WPCP



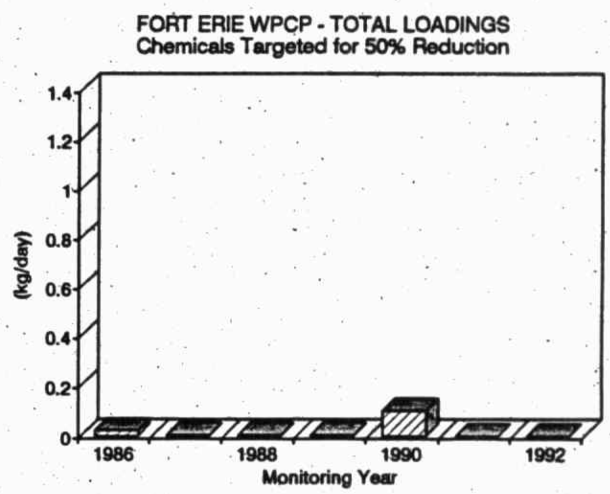


Fig. 16: Proportional loadings of the Chemicals of Concern for the Fort Erie WPCP.

The original water pollution control plant for Fort Erie was commissioned in 1963. This plant was designed for the primary treatment of 9 000 m^3 per day of sewage. The plant was expanded in 1974 to handle 23 500 m^3 per day. The plant was again expanded and upgraded in 1989. At this time the entire system was replaced in order to provide both primary and secondary treatment for a normal dry weather flow of 24 500 m^3 per day, and a peak flow of 49 000 m^3 per day. The old plant facilities were left in place to provide primary treatment for an additional 49 000 m^3 per day during conditions of excessive storm water flow.

Normal wastewater treatment consists of screening, grit removal, primary treatment, secondary treatment using the extended aeration activated sludge process, clarification and chlorine disinfection. Waste sludge generated during the extended aeration is conditioned and thickened prior to digestion. The supernatant from the digesters is returned to the plant for treatment. The digested sludge is hauled away for disposal.

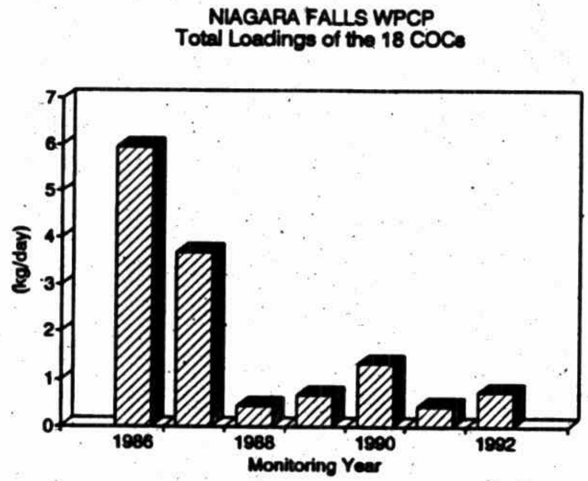
Loadings for this facility are presented in Table 17. In 1992 lead was the only chemical of concern determined in the effluent, and was only found in trace concentrations (Appendix C). No chemicals targeted for 50 per cent reduction were determined in this facility's effluent in 1992.

McMaster Avenue Combined Sewer Overflow (CSO)

The McMaster Avenue CSO is a 32" combined sewer outfall which carries industrial process wastewater and cooling water, domestic waste and storm water, with 95% of dry weather flow being attributed to industrial sources.

Loadings for this outfall are presented in Table 18 and the corresponding concentrations of chemicals in the discharge in Appendix C. In 1989 this sewer line was connected to the Welland WPCP so that wastes would be treated prior to discharging into the Welland River. This discharge is now part of the effluent monitored at the Welland WPCP and has thus ceased to be a separate point source.

Niagara Falls (Stamford) WPCP



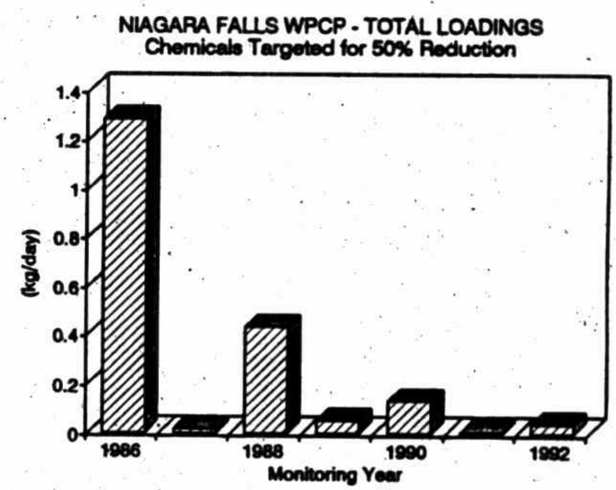


Fig. 17: Proportional Loadings of the Chemicals of Concern for the Niagara Falls WPCP.

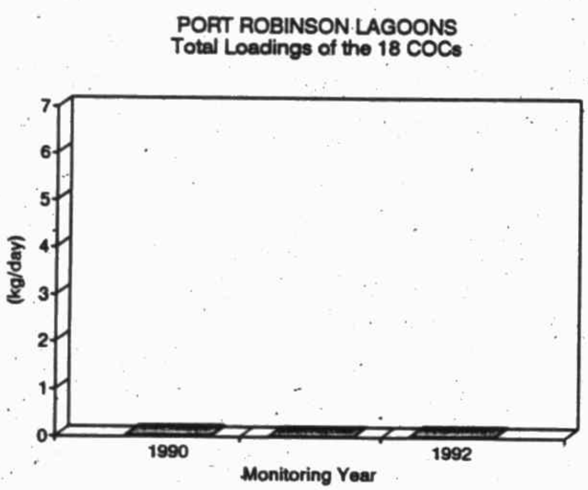
The Niagara Falls sewage treatment plant is located on Stanley Avenue. The facility treats sewage collected from the urban area of the City of Niagara Falls. Effluent from the plant is discharged to the Queenston-Chippawa Power Canal which flows into the Niagara River through the hydro generating station.

The original primary treatment system was commissioned in 1963 with an average daily design flow capacity of 45 500 m^3 per day. A major expansion in 1978 increased the primary treatment capacity to 54 600 m^3 per day. A second major upgrade occurred in 1985 which increased the plant capacity to 68 200 m^3 per day. At this time secondary treatment was added in the form of rotating biological contactors (RBCs).

Wastewater enters the plant by gravity and passes through a series of manually cleaned bar screens. The wastewater then undergoes grit removal and pre-aeration prior to entering the primary settling tanks. Clarified sewage enters the secondary treatment stage. Secondary treatment is in the form of 35 RBCs in a series of five trains. These units were designed to accommodate shock loadings arising from the canning/grape crushing season. Ferric chloride is added at numerous locations throughout the treatment for phosphorus removal. Sludge stabilization is accomplished using a two-stage anaerobic digestion process. The final disposal of stabilized sludge occurs as a soil conditioner for agricultural lands.

Loadings for this facility are presented in Table 19. Improvements made through the optimization of RBC treatment and reduced secondary treatment by-passing has lead to an 85 per cent reduction in metals loading, including the elimination of arsenic, from this facility in 1992. Mercury and lead, remain the major component of the toxics loadings from this facility. Mercury was found only once at a trace concentration in 1992. Lead comprises nearly 95 per cent of the loading of the chemicals of concern. Lead has decreased 81 per cent since 1986 and is no longer determined on a constant basis. A single determination of tetrachloroethylene likely represents an industrial spill to the sanitary sewer system. Similarly, there is no known source of octachlorostyrene to this plant, making its determination an anomaly that cannot be anticipated to be repeated.

Port Robinson Lagoons



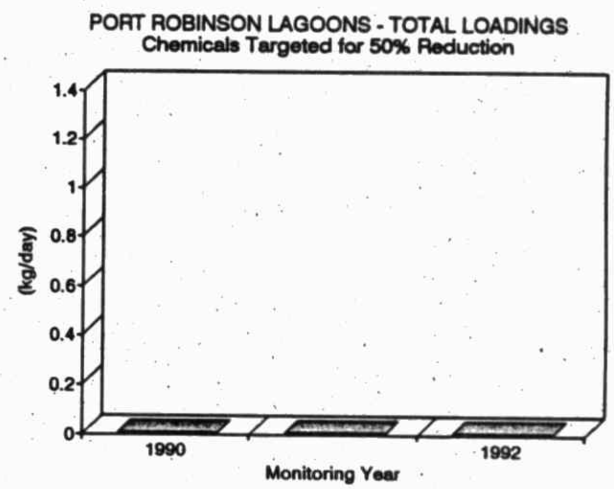


Fig. 18: Proportional loadings of the Chemicals of Concern for the Port Robinson Lagoons.

The wastewater treatment facility for the community of Port Robinson was commissioned in 1990 and is designed to treat up to 441 m^3 per day of sewage.

Influent sewers connect to an aerated lagoon with a hydraulic retention time of 5 days. The partially treated sewage from the aerated lagoon then enters two facultative cells which provide a hydraulic retention time of 76 days.

Effluent is continually discharged to the Welland River via a submerged outfall.

Loadings from the lagoons are presented in Table 20. Trace amounts of arsenic and mercury and variable levels of lead remain the only chemicals of concern to be determined in this facility's effluent (Table 20).

Queenston WPCP

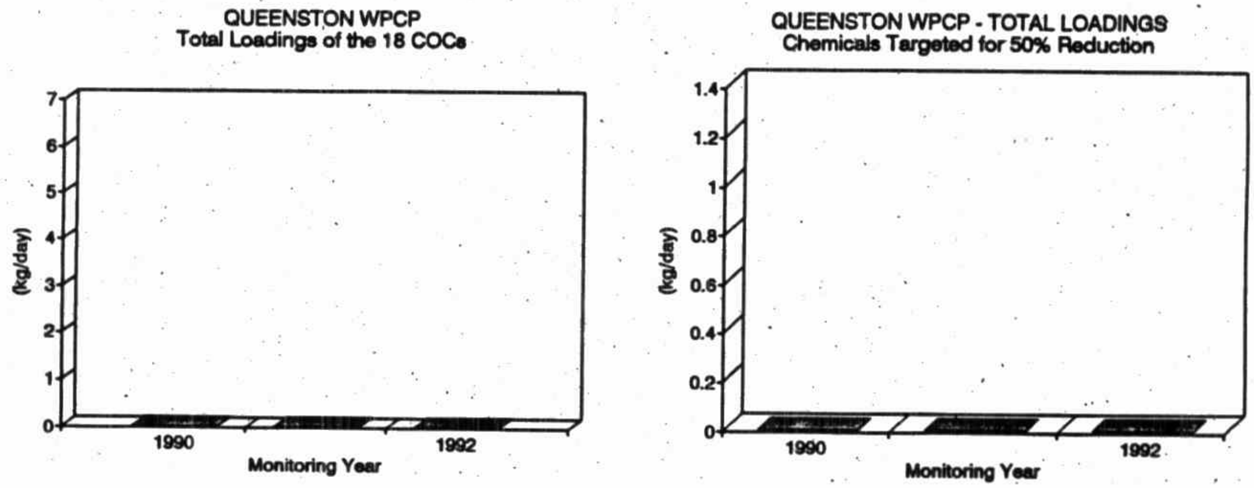


Fig. 19: Proportional Loadings of the Chemicals of Concern for the Queenston WPCP.

The Queenston WPCP was commissioned in 1990 to provide extended aeration water pollution control for 500 m^3 per day and has a peak hydraulic capacity of 1 700 m^3 per day.

Treatment consists of a velocity controlled grit removal channel, comminution followed by extended aeration. Aeration of the sewage, using coarse bubbling diffusers, occurs for a minimum of 18 hours. Following aeration, treated effluent is separated in a gravity settling tank, disinfected in a chlorine contact chamber and discharged directly to the Niagara River via a shore-based headwall outlet.

Loadings for this facility are presented in Table 21. Trace quantities of lead and tetrachloroethylene and were determined on an occurrence basis. As there are no industrial effluents routed to this facility, the detection of these compounds indicate an isolated input to the sewer system rather than a chronic source problem.

Stanley Avenue CSO

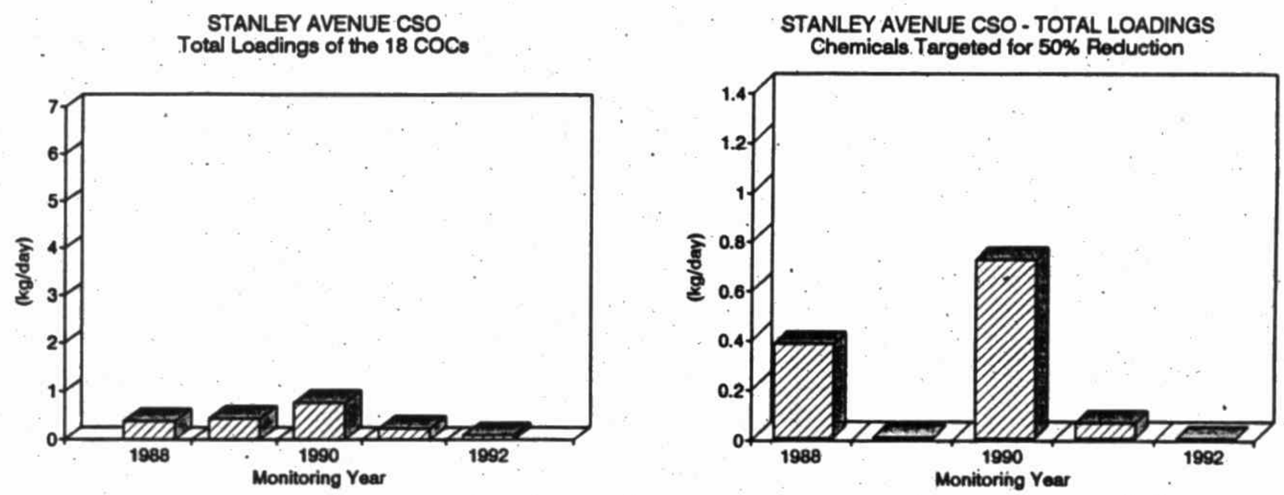


Fig. 20: Proportional loadings of the Chemicals of Concern for the Stanley Ave CSO.

The Stanley CSO is a 42" segregated sewer which discharges surface runoff and industrial non-contact cooling water from Washington Mills Electro Minerals Corp. to Chippawa Creek, a tributary of the Niagara River.

Loadings for this outfall are presented in Table 22. 1992 loadings were reduced 73.7 per cent from 1986 levels, with trace quantities of arsenic and lead being present in the effluent (Appendix C). No chemicals scheduled for 50 per cent reduction were determined at this location in 1992.

Stevensville-Douglastown Lagoons

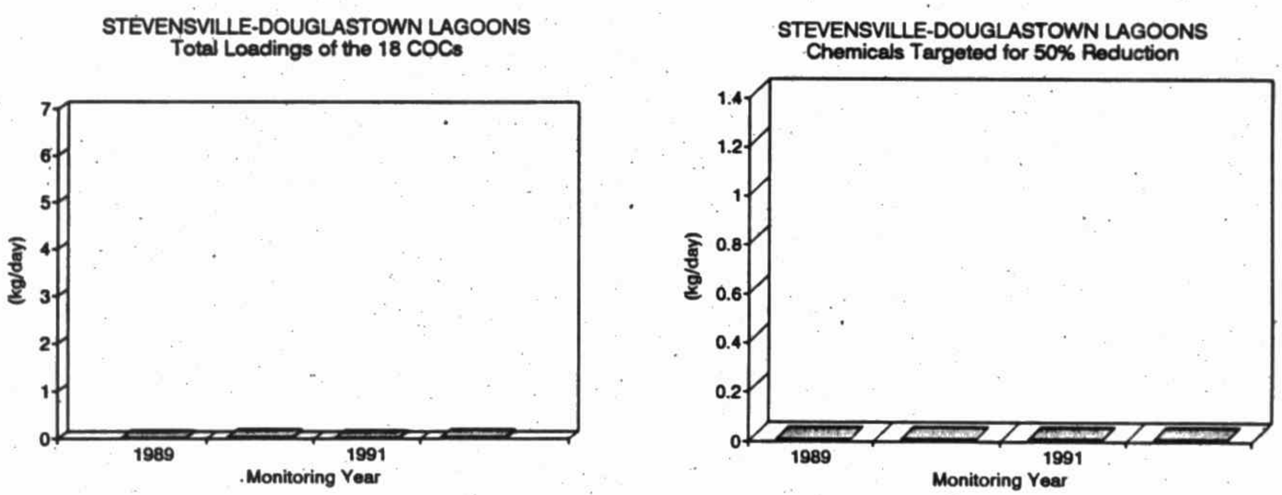


Fig. 21: Proportional loadings of the Chemicals of Concern for the Stevensville-Douglastown Lagoons.

The Stevensville-Douglastown Lagoons were commissioned in 1983 to handle a designed average daily flow rate of 2 289 m³ per day.

The facility offers facultative stabilization lagoon treatment through two cells, with room for expansion to three cells. The hydraulic retention time for lagoons is 103 days at the design average flow rate of 2 289 m³ per day. The peak hydraulic flow rate is 2 940 m³ per day.

Effluent from the lagoons discharges continuously to the Niagara River. The discharge pipe and diffuser extend 137 meters into the river at a depth of 5 meters.

Loadings for the Stevensville-Douglastown Lagoons are presented in Table 23. Trace amounts of arsenic and lead were found in the effluent (Appendix C). Chlordane was determined on a single event. Given that this compound was discontinued from general use in 1990, the determination of gamma chlordane is probably related to a historic use rather than a current source. No chemicals scheduled for 50 per cent reduction have been determined in this facility's effluent.

Welland WPCP

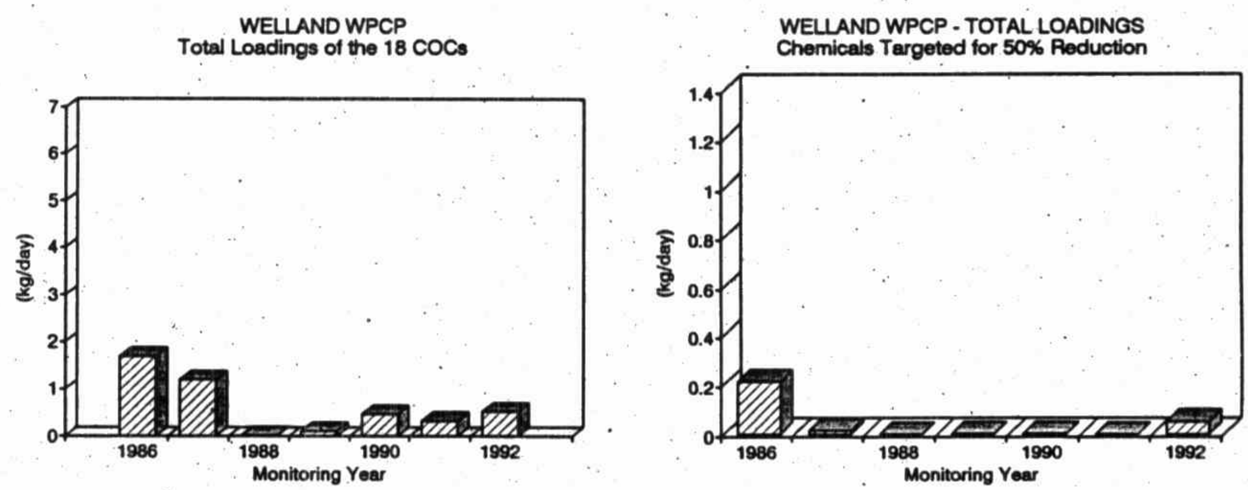


Fig. 22: Proportional loadings of the Chemicals of Concern for the Welland WPCP.

The original plant was commissioned in 1968 providing primary treatment for up to 36 300 m³ per day of sewage. In 1974 secondary treatment was added and capacity increased to 45 400 m³ per day. In 1982 the system was again upgraded to increase plant capacity to 54 500 m³ per day. In 1989 the plant was modified to split dry and wet weather flows.

The plant employs screening and grit removal for all sewage, primary, secondary (activated sludge, and phosphorus removal) and tertiary treatment (filtration, nitrification and chlorination) for dry weather flow. Storm flow receives primary treatment aided by flocculation. Any excess capacity available in the secondary/tertiary system is utilized for storm flow.

Sludge removed from the primary tanks is pumped into a two phase anaerobic digestion system. The primary digester is heated and mixed to enable the digestion process to be completed. The secondary digester provides still conditions which allows the digested sludge to settle. The supernatant produced from this digester is returned to the plant for treatment. The stabilized sludge is removed for application to agricultural lands as a soil conditioner.

In 1989, the discharge from the McMaster Ave. CSO was diverted to this facility for treatment.

Loadings from this facility are presented in Table 24. Lead remains the dominant chemical of concern in this facility's loadings of the chemicals of concern, comprising 90 per cent of this load. However, the frequency of lead determinations has become sporadic due to improved treatment the plant. Similarly, tetrachloroethylene was determined at trace levels on two individual samplings, suggesting isolated inputs rather than a chronic industrial source. A single determination of mercury was made at a relatively high concentration, also suggesting an isolated input to the sewer system.

MISA MONITORING

BACKGROUND

In Ontario most industrial point source dischargers fall under the Municipal-Industrial Strategy for Abatement (MISA) program. MISA was designed to implement a legislated, uniform approach to the reduction and virtual elimination of persistent toxics to the environment. The first phase of this program was an effluent monitoring program of 300 point source dischargers in 9 industrial sectors. Eight facilities discharging to the Niagara River or its tributaries are involved in the MISA program. These are: Atlas Specialty Steels in the Iron and Steel Sector; CanadianOxy Chemicals and Geon Canada in the Organic Chemical Sector; Cyanamid Niagara and Welland, Norton Advanced Ceramics, Washington Mills Ltd. and Washington Mills Electro Minerals in the Inorganic Chemical Sector. Since much of the MISA monitoring program is directly related to the Niagara River Toxics Management Plan, there is an exchange of resources between the two programs.

DATA EVALUATION

The monitoring phase was used to characterize categories of industrial effluents. Results of this monitoring phase are summarized by facility for the Niagara River chemicals of concern. In comparing MISA monitoring data with that of the Niagara River Improvement Project, several differences in calculations should be noted. The MISA Program is based on an end of pipe approach. It evaluates only final outfalls. Intake information is not considered in this program. Some facilities did monitor intakes on a voluntary basis, however, these were for a limited number of parameters. The MISA data presented here provides net loadings, where applicable, when available. MISA data includes concentrations for parameters found at extremely low levels. If a parameter was found at a concentrations above the method detection limit in at least 10 per cent of all samples, the remaining samples are considered to be one-tenth of the analytical method detection limit. The Niagara River Improvement Project utilizes values which are reported as a fraction of the analytical method detection limits and assumes that samples with analytically unquantifiable results for a given parameter have a concentration of zero for that parameter.

Data collected under both the MISA Program and the Niagara River Improvement Project are not significantly different with respect to analytical results. Some variation exists, but this is related to differences in loadings calculations. Factors affecting calculated loadings include no netting of loadings for facilities both drawing from and discharging to the Niagara River and its tributaries, inherent variability associated with differences in sampling frequency, and variability of effluent quality. Overall, a strong database has been developed which characterizes industrial effluents.

The MISA Program is currently in a interim phase, shifting from monitoring to prevention and abatement. The data collected during the initial monitoring phase is being reviewed for each facility on a sector-specific basis. Effluent discharge limits are being set for problematic parameters at an industry-specific level and all sectors will be required to have effluents which are not acutely lethal to Daphnia magna or rainbow trout (Salmo gairdneri). Regulations were promulgated for the Petroleum and Pulp and Paper sectors late in 1993.

CONCLUSIONS

The results of continued toxics monitoring indicate that the Niagara River Toxics Management Plan goal of a 50 percent reduction in the loadings of 10 targeted toxic chemicals to the Niagara River has been achieved and maintained in the Ontario Area of Concern through 1992. Eleven facilities have entirely eliminated the targeted compounds from their effluent, while the remaining facilities have reduced loadings of these compounds by 73 to 99 per cent.

An overall decrease in loadings of 79 per cent has been achieved for the eighteen chemicals of concern for the Niagara River between the 1986 baseline year and 1992. While this appears 4 per cent higher than 1991, a reduction in contaminant concentrations did occur in 1992. This difference can be accounted for as follows: the Chemicals of Concern were detected in only six per cent of the samples. The majority of these determinations, 78 per cent, are at trace levels. While trace results confirm the presence of a contaminant, these results are approaching such low concentrations that the analyses are approaching the threshold of quantification. The determination of compounds at such low levels may represent background levels of contamination or analytical interference. A reduction to quarterly sampling may also bias loadings as more frequent sampling acts to balance variations in determinations and concentrations. MISA monitoring data confirms the results of the Niagara River Improvement Project study by providing similar analytical results.

Loadings reductions are a continuance of the improved waste water treatment at 18 facilities as outlined in Appendix J, the re-routing of the effluent from two facilities to municipal sewer systems, the closed looping of a discharge point and the closure of a facility. These latter actions will eliminate three individual point source discharge points to the Niagara River. Additional reductions in total loadings to the river are expected with the implementation of the MISA Limits Regulations. This will decrease the impacts of both conventional pollutants and persistent toxics to the Niagara River.

APPENDICES

APPENDIX A

The 18 Chemicals of Concern for the Niagara River

Arsenic	
Mercury	Scheduled for 50% Reduction
Lead	
Benz(a)anthracene	Scheduled for 50% Reduction
Benzo(a)pyrene	Scheduled for 50% Reduction
Benzo(b)fluoranthene	Scheduled for 50% Reduction
Benzo(k)fluoranthene	Scheduled for 50% Reduction
Chrysene	
Tetrachloroethylene	Scheduled for 50% Reduction
Octachlorostyrene	
Hexaclorobenzene	Scheduled for 50% Reduction
PCBs	Scheduled for 50% Reduction
Mirex	Scheduled for 50% Reduction
Alpha Chlordane*	
Gamma Chlordane*	
Oxychlordane*	
Dieldrin	
Toxaphene	
DDT–o**	
DDT–p**	
Dioxin	Sheduled for 50% Reduction

* Reduction comittment is for chlordane and its derivatives

** Reduction comittment is for DDT and metabolites

APPENDIX B

YEARLY TOTAL LOADINGS OF THE 18 CHEMICALS OF CONCERN

TABLE 1: YEARLY TOTAL LOADINGS OF THE 18 CHEMICALS OF CONCERN FOR ALL FACILITIES

	1986 LOADING Kg/Day	1986 DETECTS/ SAMPLES	1986 % of Total Loading	1987 LOADING Kg/Day	1987 DETECTS/ SAMPLES	1987 % of Total Loading	1988 LOADING Kg/Day	1988 DETECTS/ SAMPLES	1988 % of Total Loading	1989 LOADING Kg/Day	1989 DETECTS/ SAMPLES	1989 % of Total Loading
Arsenic	2.7325	53/83	20.0831	3.606	28/52	47.0306	0.893	3/69	19.9076	0.1113	19/146	4.46914
Mercury*	0.09351	79/96	0.68727	0.105	32/52	1.36945	0.0341	24/67	0.76019	0.0257	32/135	1.03204
Lead	9.341	66/85	68.6537	3.951	32/50	51.5304	2.736	12/64	61.0361	2.2372	84/125	89.6325
Benz(a)anthracene*	0	0/22		0	0/35		0	0/37		0.041	1/73	1.64631
Benzo(a)pyrene*	0	0/20		0	0/35		0	0/37		0	0/73	
Benzo(a)fluoranthene*	0	0/20		0	0/24		0	0/15		0.033	1/74	1.32506
Benzo(k)fluoranthene*	0	0/20		0	0/23		0	0/22		0	0/63	
Chrysene	0	0/22		0	0/35		0	0/40	0	0	0/77	
Tetrachloroethylene*	1.3649	5/26	10.0316	0.0003	1/32	0.00391	0.815	6/34	18.1666	0.04	2/92	1.6082
Octachlorostyrene	0	0/9		0	0/3		0	0/6		0	0/17	
Hexachlorobenzene*	0	0/42		0.00201	2/30	0.02625	0	0/35		0.0002	1/99	0.00803
PCBs*	0.073	2/47	0.53653	0.002	1/55	0.02606	0	0/40	0	0	0/184	0
Mirex*	0	0/47		0	0/48		0	0/41		0	0/79	
Alpha Chlordane	0.00005	1/39	0.00037	0	0/42	0	0.00005	1/41	0.00111	0.0004	2/86	0.01606
Gamma Chlordane	0	0/41		0.00099	5/45	0.01291	0.00556	5/41	0.12395	0	0/86	
Oxychlordane	0	0/47		0	0/44		0	0/41		0	0/86	
Dieldrin	0.001	3/43	0.00735	0.00002	2/45	0.00026	0.00001	2/41	0.00022	0.00021	1/73	0.00843
Toxaphene	0	0/7		0	0/3		0	0/3		0	0/19	
DDT-p	0	0/35		0	0/35		0	0/36		0.0014	1/86	0.05622
DDT-o	0	0/35		0	0/35		0	0/36		0	0/86	0
TOTAL	13.606		100	7.66732		100	4.46572		100	2.49041		100
% Reduction Vs. 1986				43.6			67.0			81.7		
TOTAL *	1.53141			0.10931			0.8491			0.1399		
% Reduction Vs. 1986				92.9			44.6			90.9		

	1990 LOADING Kg/Day	1990 DETECTS/ SAMPLES	1990 % of Total Loading	1991 LOADING Kg/Day	1991 DETECTS/ SAMPLES	1991 % of Total Loading	1992 LOADING Kg/Day	1992 DETECTS/ SAMPLES	1992 % of Total Loading
Arsenic	0.053	6/204	1.18022	0.11526	29/256	5.06051	0.03745	16/92	1.32225
Mercury*	0.15107	17/203	3.36409	0.00609	16/256	0.26747	0.00736	10/92	0.26069
Lead	3.3702	156/212	75.0484	2.0933	154/256	91.9066	2.69666	71/92	95.2821
Benz(a)anthracene*	0.04102	4/45	0.91344	0	0/256		0	0/92	
Benzo(a)pyrene*	0.00009	5/140	0.002	0	0/256		0	0/92	
Benzo(a)fluoranthene*	0.0331	5/155	0.73706	0.03	1/255	1.31716	0	0/92	
Benzo(k)fluoranthene*	0.0001	6/124	0.00223	0	0/256		0	0/92	
Chrysene	0.0251	1/155	0.55893	0	0/256		0.00005	1/92	0.00177
Tetrachloroethylene*	0.817	6/166	18.1932	0.03297	9/256	1.44756	0.0887	6/92	3.13175
Octachlorostyrene	0	0/196		0.00001	1/256	0.00044	9E-06	2/92	0.00032
Hexachlorobenzene*	0	0/206		0	0/256		0	0/92	
PCBs*	0	0/174		0	0/256		0	0/92	
Mirex*	0	0/154		0	0/256		0	0/92	-
Alpha Chlordane	0	0/157		0	0/256		0.00002	2/92	0.00074
Gamma Chlordane	0.00002	1/157	0.00045	2E-08	1/256	0.00009	0	0/92	
Oxychlordane	0	0/157		0	0/256		0.00001	1/92	0.00042
Dieldrin	0	0/161		0	0/256		0	0/92	
Toxaphene	0	0/116		0	0/256		0	0/92	
DDT-p	0	0/131		0	0/256		0	0/92	
DDT-o	0	0/131		0	0/256		0	0/92	
TOTAL	4.4907		100	2.27763		100	2.83229		100
% Reduction Vs. 1986	67.0			83.3			79.2		
TOTAL *	1.04236			0.06906			0.09606		
% Reduction Vs. 1986	31.9			95.5			93.7		

* Parameters Scheduled for a 50% Reduction By 1996 .
DETECTS/SAMPLES – The number of times a parameter was detected/ number of samples taken for that parameter

TABLE 2: YEARLY TOTAL LOADINGS OF THE 18 CHEMICALS OF CONCERN FOR INDUSTRIAL FACILITIES

	1986		1987		1988		1989		1990		1991		1992	
	LOADING Kg/Day	DETECTS/ SAMPLES	LOADING Kg/Day	DETECTS/ SAMPLES	LOADING Kg/Day	DETECTS/ SAMPLES	LOADING Kg/Day	DETECTS/ SAMPLES	LOADING Kg/Day	DETECTS/ SAMPLES	LOADING Kg/Day	DETECTS/ SAMPLES	LOADING Kg/Day	DETECTS/ SAMPLES
Arsenic	0.03925	32/62	0.646	11/35	0.893	3/40	0.0993	15/104	0.048	5/146	0.06076	18/186	0.02597	8/64
Mercury*	0.00651	52/64	0.067	16/35	0.0191	13/45	0.006	13/91	0.01137	19/145	0.00209	8/186	0.00033	7/64
Lead	2.651	45/62	0.621	15/33	2.078	4/45	0.4772	49/81	1.0582	111/154	1.1323	106/186	0.99756	50/64
Benz(a)anthracene*	0	0/18	0	0/19	0	0/20	0.041	1/47	0.04102	4/95	0	0/186	0	0/64
Benzo(a)pyrene*	0	0/16	0	0/19	0	0/20	0	0/36	0.00009	5/96	0	0/186	0	0/64
Benzo(a)fluoranthene*	0	0/16	0	0/19	0	0/4	0	0/50	0.0331	5/111	0	0/186	0	0/64
Benzo(k)fluoranthene*	0	0/16	0	0/16	0	0/5	0	0/69	0.0001	6/74	0	0/186	0	0/64
Chrysene	0	0/18	0	3/18	0	0/20	0	0/17	0.0251	1/105	0	0/186	0.00005	1/64
Tetrachloroethylene*	0	0/14	0.0003	1/15	0.015	2/13	1E−06	1/69	0.005	1/88	0.00292	7/186	0.00046	2/64
Octachlorostyrene	0	0/2	0	0/6		NA	0	0/17	0	0/146	0.00001	1/186	0	0/64
Hexachlorobenzene*	0	0/26	0.00001	1/15	0	0/16	0.0002	1/67	0	0/152	0	0/186	9E−06	2/64
PCBs*	0	1/30	0.002	1/30	0	0/19	0	0/154	0	0/121	0	0/186	0	0/64
Mirex*	0	0/31	0	0/22	0	0/20	0	0/39	0	0/101	0	0/186	0	0/64
Alpha Chlordane	0	0/23	0	0/24	0	0/20	0	0/40	0	0/104	0.00005	1/186	0	0/64
Gamma Chlordane	0.00005	1/25	0.00099	5/27	0	0/20	0	0/55	0	0/104	0	0/186	0.00001	1/64
Oxychlordane	0	0/31	0	0/22	0	0/20	0	0/157	0	0/100	0	0/186	0	0/64
Dieldrin	0.00002	2/27	0	0/24	0.00001	2/20	0.00021	1/46	0	0/104	0	0/186	0.00001	1/64
Toxaphene	0	0/2		NA	0	0/20	0	0/8	0	0/74	0	0/186	0	0/64
DDT−p	0	0/19	0	0/16	0	0/20	0.0014	1/39	0	0/76	0	0/186	0	0/64
DDT−o	0	0/19	0	0/16	0	0/20	0	0/39	0	0/76	0	0/186	7E−06	0/64
TOTAL	2.69683		1.3373		3.00511		0.62531		1.22198		1.19813		1.02441	
% Reduction Vs. 1986			50.4		+11.4		76.8		54.7		55.6		62.0	
TOTAL *	0.00851		0.06731		0.0341		0.0472		0.09068		0.00501		0.0008	
% Reduction Vs. 1986			+691.0		+300.7		+400.7		+34.7		41.1		90.6	

* Parameters Scheduled for a 50% Reduction By 1996

DETECTS/SAMPLES – The number of times a parameter was detected/ number of samples taken for that parameter

TABLE 3: YEARLY TOTAL LOADINGS OF THE 18 CHEMICALS OF CONCERN FOR MUNICIPAL FACILITIES

	1986 LOADING Kg/Day		1987 LOADING Kg/Day		1988 LOADING kg/Day	DETECTS/ SAMPLES	1989 LOADING Kg/Day	DETECTS/ SAMPLES	1990 LOADING Kg/Day	DETECTS/ SAMPLES	1991 LOADING Kg/Day	DETECTS/ SAMPLES	1992 LOADING Kg/Day	DETECTS/ SAMPLES
Arsenic	2.34	21/21	2.96	17/17	0	0/19	0.012	4/44	0.005	3/58	0.0545	11/70	0.01148	8/28
Mercury*	0.087	22/22	0.038	16/16	0.015	11/22	0.0197	19/44	0.1397	8/58	0.004002	10/70	0.00705	3/28
Lead	6.69	23/23	3.33	17/17	0.66	8/19	1.76	35/44	2.312	47/58	0.961	48/70	1.7011	21/28
Benz(a)anthracene*	0	0/4	0	0/16	0	0/17	0	0/27	0	0/50	0	0/70	0	0/21
Benzo(a)pyrene*	0	0/4	0	0/16	0	0/17	0	0/27	0	0/44	0	0/70	0	0/21
Benzo(b)fluoranthene*	0	0/4	0	0/5	0	0/11	0	0/27	0	0/44	0.03	1/69	0	0/21
Benzo(k)fluoranthene*	0	0/4	0	0/7	0	0/17	0	0/27	0	0/50	0	0/70	0	0/21
Chrysene	0	0/4	0	0/17	0	0/20	0	0/27	0	0/50	0	0/70	0.000068	1/28
Tetrachloroethylene*	1.36	5/12	0	0/17	0.8	4/21	0.04	2/23	0.812	5/50	0.03215	3/70	0.0841	4/28
Octachlorostyrene	0	0/7	0	0/6	0	0/6		NA	0	0/50	0	0/70	0	0/28
Hexachlorobenzene*	0	0/16	0.002	1/15	0	0/21	0	0/32	0	0/54	0	0/70	0	0/28
PCBs*	0.073	2/16	0	0/26	0	0/21	0	0/30	0	0/53	0	0/70	0	0/28
Mirex*	0	0/16	0	0/26	0	0/21	0	0/30	0	0/53	0	0/70	0	0/28
Alpha Chlordane	0	0/16	0	0/18	0.00005	1/21	0.0004	2/46	0	0/53	0	0/70	0	0/28
Gamma Chlordane	0	0/16	0	0/18	0.00556	5/21	0	0/31	0.00002	1/53	2.0E-06	1/70	8.0E-06	1/28
Oxychlordane	0	0/16	0	0/20	0	0/21	0	0/27	0	0/57	0	0/70	0	0/28
Dieldrin	0.001	1/16	0	0/21	0	0/21	0	0/27	0	0/57	0	0/70	0	0/28
Toxaphene	0	0/5	0	0/3	0	0/3	0	0/11	0	0/44	0	0/70	0	0/28
DDT-p	0	0/16	0	0/19	0	0/21	0	0/27	0	0/55	0	0/70	0	0/28
DDT-o	0	0/16	0	0/19	0	0/21	0	0/27	0	0/55	0	0/70	0	0/28
TOTAL	10.551		6.33		1.48061		1.8321		3.26872		1.081654		1.803806	
% Reduction Since 1986			40.00569		85.96711		82.63577		69.01981		89.74833		82.90393	
TOTAL*	1.52		0.04		0.815		0.0597		0.9517		0.066152		0.007118	
% Reduction Since 1986			97.36842		46.38158		96.07237		37.38816		95.64789		99.53171	

* Parameters Scheduled for a 50% Reduction by 1996

DETECTS/SAMPLES – The number of times a parameter was detected / number of samples taken for that parameter

TABLE 4: ATLAS STEELS TOTAL LOADINGS

	1986 LOADING Kg/Day	1986 NO. OF SAMPLES	1987 LOADING Kg/Day	1987 NO. OF SAMPLES	1988 LOADING Kg/Day	1988 NO. OF SAMPLES	1989 LOADING Kg/Day	1989 NO. OF SAMPLES	1990 LOADING Kg/Day	1990 NO. OF SAMPLES	1991 LOADING Kg/Day	1991 NO. OF SAMPLES	1992 LOADING Kg/Day	1992 NO. OF SAMPLES
Arsenic	0.047	8/8	not analyzed		0.85	2/2	0	0/3	0	0/12	0.05	1/9	0	0/4
Mercury*	0.004	8/8	not analyzed		0.005	2/2	0	0/4	0.001	3/12	0	0/9	0	0/4
Lead	0.05	8/8	not analyzed		2	2/2	0	0/1	0.39	11/12	0.41	7/9	0.22	3/4
Benz(a)anthracene*	not analyzed		0	0/2	not analyzed		0	0/6	0	0/18	0	0/9	0	0/4
Benzo(a)pyrene*	not analyzed		0	0/2	not analyzed		0	0/6	0	0/18	0	0/9	0	0/4
Benzo(b)fluoranthene*	not analyzed		not analyzed		not analyzed		0	0/6	0	0/18	0	0/9	0	0/4
Benzo(k)fluoranthene*	not analyzed		not analyzed		not analyzed		0	0/6	0	0/18	0	0/9	0	0/4
Chrysene	not analyzed		0	0/2	0	0/1	0	0/6	0	0/18	0	0/9	0	0/4
Tetrachloroethylene*	0	0/3	0	0/3	0	0/2	0	0/6	0	0/18	0	0/9	0	0/4
Octachlorostyrene	not analyzed		not analyzed		not analyzed		0	0/6	0	0/18	0	0/9	0	0/4
Hexachlorobenzene*	0	0/8	0	0/3	not analyzed		0	0/6	0	0/18	0	0/9	0	0/4
PCBs*	0	0/8	0	0/3	0	0/2	0	0/6	0	0/18	0	0/9	0	0/4
Mirex*	0	0/8	0	0/3	0	0/2	0	0/6	0	0/18	0	0/9	0	0/4
Alpha Chlordane	0	0/2	0	0/3	0	0/2	0	0/6	0	0/18	0	0/9	0	0/4
Gamma Chlordane	0	0/2	0	0/3	0	0/2	0	0/6	0	0/18	0	0/9	0	0/4
Oxychlordane	0	0/2	0	0/3	0	0/2	0	0/6	0	0/18	0	0/9	0	0/4
Dieldrin	0	0/2	0	0/3	0	0/2	0	0/6	0	0/13	0	0/9	0	0/4
Toxaphene	not analyzed		not analyzed		not analyzed		0	0/6	0	0/18	0	0/9	0	0/4
DDT-p	0	0/2	0	0/3	0	0/2	0	0/6	0	0/11	0	0/9	0	0/4
DDT-o	0	0/2	0	0/3	0	0/2	0	0/6	0	0/13	0	0/9	0	0/4
TOTAL	0.101		0		2.855		0		0.391		0.46		0.22	
% Reduction Since 1986			100		+2727		100		+287		+356		+118	
TOTAL*	0.004		0		0.005		0		0.001		0		0	
% Reduction Since 1986			100		+25		100		75		100		100	

* Chemicals targeted for a 50% reduction by 1996

DETECTS/SAMPLES – The Number of times a compound was detected/The Number of samples taken for that parameter.

TABLE 5: CANADIAN OCCIDENTAL CHEMICALS TOTAL LOADINGS

	1986 LOADING Kg/Day	NO. OF SAMPLES	1987 LOADING Kg/Day	NO. OF SAMPLES	1988 LOADING Kg/Day	NO. OF SAMPLES	1989 LOADING Kg/Day	NO. OF SAMPLES	1990 LOADING Kg/Day	NO. OF SAMPLES	1991 LOADING Kg/Day	NO. OF SAMPLES	1992 LOADING Kg/Day	NO. OF SAMPLES
Arsenic	0.004	1/1	0.03	1/1	0	0/5	0	0/3	0	0/3	0.00006	1/10	0	0/4
Mercury*	0.00001	1/1	0.0004	1/1	0	0/5	0	0/3	0	0/3	0	0/10	0	0/4
Lead	0.001	1/1	0.02	1/1	not analyzed		0	0/3	0.001	2/3	0.0003	5/10	0.0008	3/4
Benz(a)anthracene*	0	0/1	0	0/3	0	0/3	0	0/3	not analyzed		0	0/10	0	0/4
Benzo(a)pyrene*	0	0/1	0	0/3	0	0/3	0	0/2	not analyzed		0	0/10	0	0/4
Benzo(b)fluoranthene*	0	0/1	0	0/3	not analyzed		0	0/2	not analyzed		0	0/10	0	0/4
Benzo(k)fluoranthene*	0	0/1	0	0/3	not analyzed		0	0/2	not analyzed		0	0/10	0	0/4
Chrysene	0	0/1	0	0/3	0	0/3	0	0/2	not analyzed		0	0/10	0	0/4
Tetrachloroethylene*	not analyzed		0.0003	1/1	0	0/2	0	0/2	not analyzed		0.0009	1/10	0	0/4
Octachlorostyrene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/2	0	0/10	0	0/4
Hexachlorobenzene*	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/10	0	0/4
PCBs*	not analyzed		not analyzed		not analyzed		not analyzed		0	0/4	0	0/10	0	0/4
Mirex*	not analyzed		not analyzed		not analyzed		not analyzed		0	0/4	0	0/10	0	0/4
Alpha Chlordane	not analyzed		not analyzed		not analyzed		not analyzed		0	0/4	0	0/10	0	0/4
Gamma Chlordane	not analyzed		not analyzed		not analyzed		not analyzed		0	0/4	0	0/10	0	0/4
Oxychlordane	not analyzed		not analyzed		not analyzed		not analyzed		0	0/4	0	0/10	0	0/4
Dieldrin	not analyzed		not analyzed		not analyzed		not analyzed		0	0/4	0	0/10	0	0/4
Toxaphene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/4	0	0/10	0	0/4
DDT−p	not analyzed		not analyzed		not analyzed		not analyzed		0	0/4	0	0/10	0	0/4
DDT−o	not analyzed		not analyzed		not analyzed		not analyzed		0	0/4	0	0/10	0	0/4
TOTAL	0.00501		0.0507		0		0		0.001		0.00126		0.0008	
% Reduction Since 1986			9.9		100		100		80.0		74.9		84.0	
TOTAL*	0.00001		0.0007		0		0		0		0.0009		0	
% Reduction Since 1986			9.9		100		100		100		+8900		100	

* Chemicals targeted for a 50% reduction by 1996
DETECTS/SAMPLES – The Number of times a compound was detected/The Number of samples taken for that parameter.

TABLE 6: CYANAMID CANADA – NIAGARA PLANT NET LOADINGS

	1986		1987		1988		1989		1990		1991		1992
	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	
Arsenic	0	0/6	0.043	1/8	0	0/6	0	0/12	0.0002	1/36	0.016	3/30	Facility Mothballed, No Point Source Discharge
Mercury*	0.0031	4/6	0.0005	2/8	0	0/6	0.00003	1/12	0.00009	1/36	0	0/30	
Lead	0	0/6	0.051	1/8	0.149	1/6	0.168	4/12	0.136	16/36	0.089	12/30	
Benz(a)anthracene*	0	0/9	0	0/5	0	0/6	0.041	1/12	0.00002	1/33	0	0/30	
Benzo(a)pyrene*	0	0/8	0	0/5	0	0/6	0	0/12	0	0/33	0	0/30	
Benzo(b)fluoranthene*	0	0/8	0	0/7	not analyzed		0.033	1/12	0.00002	1/33	0	0/30	
Benzo(k)fluoranthene*	0	0/8	0	0/5	0	0/6	0	0/12	0.00002	1/33	0	0/30	
Chrysene	0	0/9	0	0/5	0	0/6	0.025	1/12	0	0/33	0	0/30	
Tetrachloroethylene*	not analyzed		0	0/5	0	0/6	0	0/12	0	0/34	0.0009	1/30	
Octachlorostyrene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/34	0	0/30	
Hexachlorobenzene*	0	0/5	not analyzed		0	0/6	0	0/11	0	0/34	0	0/30	
PCBs*	0	0/4	0	0/8	0	0/6	0	0/11	0	0/34	0	0/30	
Mirex*	0	0/4	0	0/8	0	0/6	0	0/11	0	0/34	0	0/30	
Alpha Chlordane	0	0/4	0	0/8	0	0/6	0	0/11	0	0/34	0	0/30	
Gamma Chlordane	0	0/4	0	0/8	0	0/6	0	0/11	0	0/34	0	0/30	
Oxychlordane	0	0/4	0	0/8	0	0/6	0	0/11	0	0/22	0	0/30	
Dieldrin	0	0/4	0	0/8	0	0/6	0	0/11	0	0/24	0	0/30	
Toxaphene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/18	0	0/30	
DDT–p	0	0/4	0	0/8	0	0/6	0	0/11	0	0/16	0	0/30	
DDT–o	0	0/4	0	0/8	0	0/6	0	0/11	0	0/16	0	0/30	
TOTAL % Reduction Since 1986	0.0031		0.0945		0.149		0.26703		0.13635		0.1059		0
TOTAL* % Reduction Since 1986	0.0031		0.0005		0		0.07403		0.00015		0.0009		0

* Chemicals targeted for a 50 Per cent reduction by 1996

DETECTS/SAMPLES – The Number of times a compound was detected/The Number of samples taken for that parameter.

TABLE 7: CYANAMID CANADA – WELLAND PLANT NET LOADINGS

	1986		1987		1988		1989		1990		1991		1992	
	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES
Arsenic	0	0/4	0.56	3/3	0	0/3	0.09	5/11	0.04	1/18	0.005	1/20	0.0255	3/8
Mercury*	0	0/4	not analyzed		0.012	3/3	0.004	0/10	0.001	1/18	0	0/20	0	0/8
Lead	1.63	3/4	0.51	3/3	0	0/3	0.12	3/6	0.062	6/18	0.031	5/20	0.61	7/8
Benz(a)anthracene*	0	0/5	not analyzed		0	0/2	0	0/10	0	0/14	0	0/20	0	0/8
Benzo(a)pyrene*	0	0/5	not analyzed		0	0/2	0	0/10	0	0/14	0	0/20	0	0/8
Benzo(b)fluoranthene*	0	0/5	not analyzed		not analyzed		0	0/9	0	0/10	0	0/20	0	0/8
Benzo(k)fluoranthene*	0	0/5	not analyzed		not analyzed		0	0/10	0	0/14	0	0/20	0	0/8
Chrysene	0	0/5	not analyzed		0	0/2	0	0/10	0	0/14	0	0/20	0	0/8
Tetrachloroethylene*	0	0/5	0	0/1	0	0/2	0	0/10	0	0/10	0	0/20	0	0/8
Octachlorostyrene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/15	0	0/20	0	0/8
Hexachlorobenzene*	0	0/8	not analyzed		0	0/1	0	0/2	0	0/9	0	0/20	0	0/8
PCBs*	0	0/8	0	0/3	0	0/3	0	0/8	0	0/14	0	0/20	0	0/8
Mirex*	0	0/7	0	0/3	0	0/1	0	0/2	0	0/8	0	0/20	0	0/8
Alpha Chlordane	0	0/7	0	0/3	0	0/1	0	0/2	0	0/11	0	0/20	0	0/8
Gamma Chlordane	0	0/7	0	0/3	0	0/1	0	0/2	0	0/11	0	0/20	0	0/8
Oxychlordane	0	0/7	0	0/3	0	0/1	0	0/2	0	0/11	0	0/20	0	0/8
Dieldrin	0	0/7	0	0/3	0	0/1	0	0/2	0	0/11	0	0/20	0	0/8
Toxaphene	not analyzed		not analyzed		not analyzed		0	0/2	0	0/10	0	0/20	0	0/8
DDT–p	0	0/7	0	0/2	0	0/1	0	0/2	0	0/9	0	0/20	0	0/8
DDT–o	0	0/7	0	0/2	0	0/1	0	0/2	0	0/9	0	0/20	0	0/8
TOTAL	1.63		1.07		0.012		0.214		0.103		0.036		0.6355	
% Reduction Since 1986			34.4		99.3		86.9		93.7		97.8		61.0	
TOTAL*	0		0		0.012		0.004		0.001		0		0	
% Reduction Since 1986														

* Chemicals targeted for a 50% reduction by 1996

DETECTS/SAMPLES – The Number of times a compound was detected/The Number of samples taken for that parameter.

TABLE 8: FLEET INDUSTRIES TOTAL LOADINGS

	1986 LOADING Kg/Day	1986 NO. OF SAMPLES	1987 LOADING Kg/Day	1987 NO. OF SAMPLES	1988 LOADING Kg/Day	1988 NO. OF SAMPLES	1989 LOADING Kg/Day	1989 NO. OF SAMPLES	1990 LOADING Kg/Day	1990 NO. OF SAMPLES	1991 LOADING Kg/Day	1991 NO. OF SAMPLES	1992 LOADING Kg/Day	1992 NO. OF SAMPLES
Arsenic	0.016	12/12	0.001	3/7	0.0003	1/6	0.001	1/17	0	0/14	0.001	1/19	0.00022	4/8
Mercury*	0.0002	16/16	0.0016	7/7	not analyzed		0.00004	1/7	0	0/14	0.0002	2/19	2.5E−06	1/8
Lead	0.05	16/16	0.027	7/7	0.0002	1/6	0.013	7/12	0.011	19/22	0.004	11/19	0.00256	6/8
Benz(a)anthracene*	not analyzed		0	0/1	not analyzed		0	0/1	0	0/9	0	0/19	0	0/8
Benzo(a)pyrene*	not analyzed		0	0/1	not analyzed		0	0/1	0	0/9	0	0/19	0	0/8
Benzo(b)fluoranthene*	not analyzed		0	0/1	not analyzed		not analyzed		0	0/9	0	0/19	0	0/8
Benzo(k)fluoranthene*	not analyzed		not analyzed		not analyzed		0	0/1	0	0/9	0	0/19	0	0/8
Chrysene	not analyzed		0	0/1	not analyzed		0	0/1	0	0/9	0	0/19	0	0/8
Tetrachloroethylene*	0	0/9	0	0/5	0.006	2/5	0	0/15	0	0/20	0	0/19	0	0/8
Octachlorostyrene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/21	0	0/19	0	0/8
Hexachlorobenzene*	not analyzed		not analyzed		not analyzed		0	0/7	0	0/21	0	0/19	0	0/8
PCBs*	not analyzed		not analyzed		not analyzed		0	0/7	0	0/18	0	0/19	0	0/8
Mirex*	not analyzed		not analyzed		not analyzed		0	0/7	0	0/16	0	0/19	0	0/8
Alpha Chlordane	not analyzed		not analyzed		not analyzed		0	0/7	0	0/16	0	0/19	0	0/8
Gamma Chlordane	not analyzed		not analyzed		not analyzed		0	0/7	0	0/16	0	0/19	0	0/8
Oxychlordane	not analyzed		not analyzed		not analyzed		0	0/7	0	0/16	0	0/19	0	0/8
Dieldrin	not analyzed		not analyzed		not analyzed		0	0/7	0	0/15	0	0/19	0	0/8
Toxaphene	not analyzed		not analyzed		not analyzed		0	0/6	0	0/20	0	0/19	0	0/8
DDT−p	not analyzed		not analyzed		not analyzed		0	0/3	0	0/18	0	0/19	0	0/8
DDT−o	not analyzed		not analyzed		not analyzed		0	0/6	0	0/19	0	0/19	0	0/8
TOTAL	0.0662		0.0296		0.0065		0.01404		0.011		0.0052		0.002783	
% Reduction Since 1986			55.3		90.2		78.8		83.4		92.1		95.8	
TOTAL*	0.0002		0.0016		0.006		0.00004		0		0.0002		2.5E−06	
% Reduction Since 1986			+700		+2900		80		100		0		98.8	

* Chemicals targeted for a 50% reduction by 1996

DETECTS/SAMPLES – The Number of times a compound was detected/The Number of samples taken for that parameter.

TABLE 9: FORD MOTOR COMPANY – NIAGARA GLASS PLANT NET LOADINGS

	1986		1987		1988		1989		1990		1991		1992	
	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES	LOADING Kg/Day	NO. OF SAMPLES
Arsenic	0	0/6	0	0/2	0	0/7	0	0/12	0.002	2/13	0	0/20	0	0/8
Mercury*	0.0042	2/6	0	0/6	0.001	3/7	0.008	4/12	0	0/12	0.0002	3/20	8.0E−06	1/8
Lead	0.01	1/6	0	0/4	0	0/7	0.0402	8/14	0.05	13/13	0.04	13/20	0.0092	8/8
Benz(a)anthracene*	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Benzo(a)pyrene*	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Benzo(b)fluoranthene*	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Benzo(k)fluoranthene*	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Chrysene	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Tetrachloroethylene*	not analyzed		0.005	3/3	0	0/6	0/6		0.00202	3/12	0.004	1/20	0.00026	1/8
Octachlorostyrene	not analyzed		not analyzed		not analyzed		not analyzed		0.00001	3/12	0	0/20	0	0/8
Hexachlorobenzene*	not analyzed		0	0/6	0	0/5	0	0/9	0	0/12	0	0/20	2.0E−06	1/8
PCBs*	0	0/6	0	0/6	0	0/5	0	0/9	0	0/12	0	0/20	0	0/8
Mirex*	0	0/6	0	0/6	0	0/5	0	0/9	0	0/12	0	0/20	0	0/8
Alpha Chlordane	0	0/6	0	0/6	0	0/5	0	0/9	0	0/12	0.00005	3/20	0	0/8
Gamma Chlordane	0.00099	1/9	0	0/6	0	0/5	0	0/9	0	0/12	0	0/20	0	0/8
Oxychlordane	0	0/6	0	0/6	0	0/5	0	0/9	0	0/12	0	0/20	0	0/8
Dieldrin	0	0/6	0	0/6	0	0/5	0	0/9	0	0/12	0	0/20	0	0/8
Toxaphene	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
DDT−p	0	0/6	0	0/6	0	0/5	0	0/9	0	0/12	0	0/20	0	0/8
DDT−o	0	0/6	0	0/6	0	0/5	0	0/9	0	0/12	0	0/20	0	0/8
TOTAL	0.01519		0.005		0.001		0.0482		0.05203		0.04425		0.00947	
% Reduction Since 1986			67.1		93.4		+217.3		+242.5		+191.3		37.7	
TOTAL*	0.0042		0.005		0.001		0.008		0.00202		0.0042		0.00027	
% Reduction Since 1986			+19		76.2		+90.5		51.9		0		73	

* Chemicals targeted for a 50% reduction by 1996

DETECTS/SAMPLES – The Number of times a compound was detected/The Number of samples taken for that parameter.

TABLE 10: GENCORP INC. TOTAL LOADINGS

	1986 LOADING Kg/Day	NO. OF SAMPLES	1987 LOADING Kg/Day	NO. OF SAMPLES	1988 LOADING Kg/Day	NO. OF SAMPLES	1989 LOADING Kg/Day	NO. OF SAMPLES	1990 LOADING Kg/Day	NO. OF SAMPLES	1991 LOADING Kg/Day	NO. OF SAMPLES	1992 LOADING Kg/Day	NO. OF SAMPLES
Arsenic	0.01	5/9	0.03	3/3	0	0/3	0	0/6	0	0/12	0.0005	0.029	0	0/4
Mercury*	0.0001	8/8	0.0001	3/3	0	0/3	0	0/6	1.0E−06	1/12	0	0/10	0	0/4
Lead	0.06	8/8	0.03	3/3	0	0/3	0.03	3/6	0.012	12/12	0.004	5/10	0.016	3/4
Benz(a)anthracene*	0	0/4	0	0/2	not analyzed		0	0/4	0.00002	2/12	0	0/10	0	0/4
Benzo(a)pyrene*	0	0/4	0	0/2	not analyzed		0	0/4	0.00009	4/12	0	0/10	0	0/4
Benzo(b)fluoranthene*	0	0/4	0	0/1	not analyzed		0	0/4	0.0001	3/12	0	0/10	0	0/4
Benzo(k)fluoranthene*	0	0/4	0	0/2	not analyzed		0	0/4	0.0001	4/12	0	0/10	0	0/4
Chrysene	0	0/4	0	0/1	0	0/1	0	0/4	0.0001	4/12	0	0/10	0.00005	1/4
Tetrachloroethylene*	0	0/5	0	0/2	0.01	2/2	0	0/4	0	0/12	0	0/10	0.0002	1/4
Octachlorostyrene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/12	0	0/10	0	0/4
Hexachlorobenzene*	0	0/3	3.0E−06	1/3	not analyzed		0.0002	1/4	0	0/12	0	0/10	3.0E−06	1/4
PCBs*	0.002	1/4	0	0/1	0	0/1	0	0/6	0	0/12	0	0/10	0	0/4
Mirex*	0	0/4	0	0/1	0	0/1	0	0/6	0	0/12	0	0/10	0	0/4
Alpha Chlordane	0	0/4	0	0/1	0	0/1	0	0/6	0	0/12	0	0/10	0	0/4
Gamma Chlordane	0	0/4	0	0/1	0	0/1	0	0/6	0	0/12	0	0/10	0.000013	1/4
Oxychlordane	0	0/4	0	0/1	0	0/1	0	0/6	0	0/12	0	0/10	0	0/4
Dieldrin	0	0/4	0	0/1	0	0/1	0.0002	1/6	0	0/12	0	0/10	0.000012	1/4
Toxaphene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/12	0	0/10	0	0/4
DDT−p	0	0/4	0	0/1	0	0/1	0.0014	1/6	0	0/12	0	0/10	0	0/4
DDT−o	0	0/4	0	0/1	0	0/1	0	0/6	0	0/12	0	0/10	0	0/4
TOTAL	0.0721		0.060103		0.01		0.0318		0.012411		0.0045		0.016278	
% Reduction Since 1986			16.6		86.1		55.9		82.8		93.8		77.4	
TOTAL*	0.0021		0.000103		0.01		0.0002		0.000311		0		0.000203	
% Reduction Since 1986			95.1		+376		90.5		85.2		100		90.3	

* Chemicals targeted for a 50% reduction by 1996

DETECTS/SAMPLES – The Number of times a compound was detected/The Number of samples taken for that parameter.

TABLE 11: GEON CANADA (BFGOODRICH) NET LOADINGS

	1986 LOADING Kg/Day	1986 NO. OF SAMPLES	1987 LOADING Kg/Day	1987 NO. OF SAMPLES	1988 LOADING Kg/Day	1988 NO. OF SAMPLES	1989 LOADING Kg/Day	1989 NO. OF SAMPLES	1990 LOADING Kg/Day	1990 NO. OF SAMPLES	1991 LOADING Kg/Day	1991 NO. OF SAMPLES	1992 LOADING Kg/Day	1992 NO. OF SAMPLES
Arsenic	0	0/3	not analyzed		0	0/3	0.004	2/3	0	0/3	0.0005	5/8	0	0/4
Mercury*	0.009	4/4	0	0/3	0.001	3/3	0.0012	3/3	0.002	3/3	0.0003	3/8	0.00028	3/4
Lead	not analyzed		not analyzed		0	0/3	0	0/3	0	0/3	0.02	5/8	0.029	3/4
Benz(a)anthracene*	not analyzed		0	0/2	0	0/2	0	0/3	0	0/3	0	0/8	0	0/4
Benzo(a)pyrene*	not analyzed		0	0/3	0	0/2	0	0/2	0	0/3	0	0/8	0	0/4
Benzo(b)fluoranthene*	not analyzed		0	0/3	not analyzed		0	0/2	0	0/3	0	0/8	0	0/4
Benzo(k)fluoranthene*	not analyzed		0	0/3	not analyzed		0	0/2	0	0/3	0	0/8	0	0/4
Chrysene	not analyzed		0.03	2/3	0	0/2	0	0/2	0	0/3	0	0/8	0	0/4
Tetrachloroethylene*	not analyzed		not analyzed		not analyzed		not analyzed		0	0/3	0	0/8	0	0/4
Octachlorostyrene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/3	0	0/8	0	0/4
Hexachlorobenzene*	not analyzed		0	0/3	0	0/2	0	0/3	0	0/3	0	0/8	0	0/4
PCBs*	0	0/2	0	0/3	0	0/2	0	0/3	0	0/3	0	0/8	0	0/4
Mirex*	not analyzed		0	0/3	0	0/2	0	0/3	0	0/3	0	0/8	0	0/4
Alpha Chlordane	0	0/2	0	0/3	0	0/2	0	0/3	0	0/3	0	0/8	0	0/4
Gamma Chlordane	0	0/2	0	0/3	0	0/2	0	0/3	0	0/3	0	0/8	0	0/4
Oxychlordane	0	0/2	0	0/3	0	0/2	0	0/3	0	0/3	0	0/8	0	0/4
Dieldrin	0	0/2	0	0/3	0	0/2	0	0/3	0	0/3	0	0/8	0	0/4
Toxaphene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/3	0	0/8	0	0/4
DDT−p	not analyzed		0	0/3	0	0/2	0	0/3	0	0/3	0	0/8	0	0/4
DDT−o	not analyzed		0	0/3	0	0/2	0	0/3	0	0/3	0	0/8	0	0/4
TOTAL	0.009		0.03		0.001		0.0052		0.002		0.0208		0.02928	
% Reduction Since 1986			+233.3		88.9		42.2		77.8		+131.1		+225.3	
TOTAL*	0.009		0		0.001		0.0012		0.002		0.0093		0.00028	
% Reduction Since 1986			100		88.9		86.7		77.8		96.7		96.9	

* Chemicals targeted for a 50% reduction by 1996

DETECTS/SAMPLES − The Number of times a compound was detected/The Number of samples taken for that parameter.

TABLE 12: GOULD NATIONAL BATTERY TOTAL LOADINGS

	1986 LOADING Kg/Day	1986 NO. OF SAMPLES	1987 Wastewter redirected to municipal sewer system
Arsenic	0.004	1/4	
Mercury*	0.0001	4/4	
Lead	0.55	3/3	
Benz(a)anthracene*	not analyzed		
Benzo(a)pyrene*	not analyzed		
Benzo(b)fluoranthene*	not analyzed		
Benzo(k)fluoranthene*	not analyzed		
Chrysene	not analyzed		
Tetrachloroethylene*	not analyzed		
Octachlorostyrene	not analyzed		
Hexachlorobenzene*	not analyzed		
PCBs*	not analyzed		
Mirex*	not analyzed		
Alpha Chlordane	not analyzed		
Gamma Chlordane	not analyzed		
Oxychlordane	not analyzed		
Dieldrin	not analyzed		
Toxaphene	not analyzed		
DDT−p	not analyzed		
DDT−o	not analyzed		
TOTAL	0.5541		
TOTAL*	0.0010		

* Chemicals targeted for a 50% reduction by 1996

DETECTS/SAMPLES – The Number of times a compound was detected, The Number of samples taken for a parameter.

TABLE 13: NORTON ADVANCED CERAMICS NET LOADINGS

	1986 LOADING Kg/Day	1986 NO. OF SAMPLES	1987 LOADING Kg/Day	1987 NO. OF SAMPLES	1988 LOADING Kg/Day	1988 NO. OF SAMPLES	1989 LOADING Kg/Day	1989 NO. OF SAMPLES	1990 LOADING 0	1990 NO. OF SAMPLES	1991 LOADING Kg/Day	1991 NO. OF SAMPLES	1992 LOADING Kg/Day	1992 NO. OF SAMPLES
Arsenic	0.31	3/5	0	0/9	0	0/7	0.006	1/16	0	0/13	0	0/20	0	0/8
Mercury*	0.0016	5/5	0.05	3/7	0	0/7	0	0/12	0	0/13	0	0/20	0.00002	1/8
Lead	0.1	3/5	0	0/3	0	0/7	0.16	11/16	0.12	12/13	0.05	18/20	0.012	6/8
Benz(a)anthracene*	not analyzed		0	0/3	0	0/2	0	0/10	0	0/12	0	0/20	0	0/8
Benzo(a)pyrene*	not analyzed		0	0/3	0	0/2	0	0/10	0	0/12	0	0/20	0	0/8
Benzo(b)fluoranthene*	not analyzed		0	0/3	0	0/2	0	0/10	0	0/12	0	0/20	0	0/8
Benzo(k)fluoranthene*	not analyzed		0	0/3	0	0/2	0	0/10	0	0/12	0	0/20	0	0/8
Chrysene	not analyzed		0	0/3	0	0/2	0	0/10	0	0/12	0	0/20	0	0/8
Tetrachloroethylene*	0	0/1	0	0/3	0	0/7	1.0E-06	1/15	0.005	1/12	0	0/20	0	0/8
Octachlorostyrene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/12	0	0/20	0	0/8
Hexachlorobenzene*	not analyzed		not analyzed		not analyzed		not analyzed		0	0/12	0	0/20	0	0/8
PCBs*	not analyzed		0	0/7	not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Mirex*	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Alpha Chlordane	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Gamma Chlordane	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Oxychlordane	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Dieldrin	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Toxaphene	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
DDT-p	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
DDT-o	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
TOTAL	0.4116		0.05		0		0.166001		0.125		0.05		0.01202	
% Reduction Since 1986			87.9		100		59.7		69.6		87.9		97.1	
TOTAL*	0.0016		0.05		0		1.0E-06		0.005		0		0.00002	
% Reduction Since 1986			+3025		100		99.9		+212.5		100		98.8	

* Chemicals targeted for a 50% reduction by 1996

DETECTS/SAMPLES – The Number of times a compound was detected/The Number of samples taken for that parameter.

TABLE 14: STELPIPE WELLAND TUBES TOTAL LOADINGS

	1986 LOADING Kg/Day	NO. OF SAMPLES	1987 LOADING Kg/Day	NO. OF SAMPLES	1988 LOADING Kg/Day	NO. OF SAMPLES	1989 LOADING Kg/Day	NO. OF SAMPLES	1990 LOADING Kg/Day	NO. OF SAMPLES	1991 LOADING Kg/Day	NO. OF SAMPLES	1992 LOADING Kg/Day	NO. OF SAMPLES
Arsenic	0.01	2/2	not analyzed		0.001	3/3	0.003	3/3	0.002	1/4	0	0/10	0	0/4
Mercury*	not analyzed		not analyzed		2.0E-06	2/3	0.0001	1/4	0	0/4	0	0/10	0	0/4
Lead	0.001	2/2	not analyzed		0	0/3	0.002	2/3	0.02	4/4	0.03	9/10	0.02	4/4
Benz(a)anthracene*	0	0/2	not analyzed		0	0/3	0	0/3	0	0/4	0	0/10	0	0/4
Benzo(a)pyrene*	0	0/2	not analyzed		0	0/3	0	0/3	0	0/4	0	0/10	0	0/4
Benzo(b)fluoranthene*	0	0/2	not analyzed		not analyzed		0	0/4	0	0/4	0	0/10	0	0/4
Benzo(k)fluoranthene*	0	0/2	not analyzed		0	0/3	0	0/3	0	0/4	0	0/10	0	0/4
Chrysene	0	0/2	not analyzed		0	0/3	0	0/3	0	0/4	0	0/10	0	0/4
Tetrachloroethylene*	not analyzed		not analyzed		not analyzed		0	0/4	0	0/4	0	0/10	0	0/4
Octachlorostyrene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/3	0	0/10	0	0/4
Hexachlorobenzene*	0.00001	1/2	not analyzed		not analyzed		0	0/4	0	0/4	0	0/10	0	0/4
PCBs*	0	0/2	not analyzed		not analyzed		0	0/4	0	0/4	0	0/10	0	0/4
Mirex*	0	0/2	not analyzed		0	0/3	0	0/4	0	0/4	0	0/10	0	0/4
Alpha Chlordane	0	0/2	not analyzed		0	0/3	0	0/4	0	0/4	0	0/10	0	0/4
Gamma Chlordane	0	0/2	not analyzed		0	0/3	0	0/4	0	0/4	0	0/10	0	0/4
Oxychlordane	0	0/2	not analyzed		0	0/3	0	0/4	0	0/4	0	0/10	0	0/4
Dieldrin	0.00002	2/2	not analyzed		0.00001	2/3	0	0/4	0	0/4	0	0/10	0	0/4
Toxaphene	0	0/2	not analyzed		not analyzed		not analyzed		not analyzed		0	0/10	0	0/4
DDT-p	0	0/2	not analyzed		0	0/3	0	0/4	0	0/4	0	0/10	0	0/4
DDT-o	0	0/2	not analyzed		0.00002	1/3	0	0/4	0	0/4	0	0/10	0	0/4
TOTAL	0.01103		0		0.001032		0.0051		0.02		0.03		0.02	
% Reduction Since 1986			100.0		98.4		92.3		69.8		54.7		69.8	
TOTAL*	0.00001		0		2.0E-06		0.0001		0		0		0	
% Reduction Since 1986			100		80		+900		100		100		100	

* Chemicals targeted for a 50% reduction by 1996

DETECTS/SAMPLES – The Number of times a compound was detected/The Number of samples taken for that parameter.

TABLE 15: WASHINGTON MILLS LIMITED TOTAL LOADINGS

	1989 LOADING Kg/Day	1989 NO. OF SAMPLES	1990 LOADING Kg/Day	1990 NO. OF SAMPLES	1991 LOADING Kg/Day	1991 NO. OF SAMPLES	1992 LOADING Kg/Day	1992 NO. OF SAMPLES
Arsenic	0.002	3/4	0	0/6	0.001	4/10	0.00025	1/4
Mercury*	0	0/4	0	0/6	0	0/10	0.000023	1/4
Lead	0.018	4/4	0.02	6/6	0.13	10/10	0.032	3/4
Benz(a)anthracene*	not analyzed		not analyzed		0	0/10	0	0/4
Benzo(a)pyrene*	not analyzed		not analyzed		0	0/10	0	0/4
Benzo(b)fluoranthene*	not analyzed		not analyzed		0	0/10	0	0/4
Benzo(k)fluoranthene*	not analyzed		not analyzed		0	0/10	0	0/4
Chrysene	not analyzed		not analyzed		0	0/10	0	0/4
Tetrachloroethylene*	0	0/5	0	0/5	0	0/10	0	0/4
Octachlorostyrene	0	0/3	0	0/3	0	0/10	0	0/4
Hexachlorobenzene*	0	0/3	0	0/3	0	0/10	0	0/4
PCBs*	not analyzed		not analyzed		0	0/10	0	0/4
Mirex*	not analyzed		not analyzed		0	0/10	0	0/4
Alpha Chlordane	not analyzed		not analyzed		0	0/10	0	0/4
Gamma Chlordane	not analyzed		not analyzed		0	0/10	0	0/4
Oxychlordane	not analyzed		not analyzed		0	0/10	0	0/4
Dieldrin	not analyzed		not analyzed		0	0/10	0	0/4
Toxaphene	not analyzed		not analyzed		0	0/10	0	0/4
DDT-p	not analyzed		not analyzed		0	0/10	0	0/4
DDT-o	not analyzed		not analyzed		0	0/10	0	0/4
TOTAL			0.02		0.131		0.032273	
% Reduction Since 1986							75.4	
TOTAL*	0		0		0		0.000023	

* Chemicals targeted for a 50% reduction by 1996

DETECTS/SAMPLES – The Number of times a compound was detected/The Number of samples taken for that paramete

TABLE 16: WASHINGTON MILLS ELECTRO MINERALS NET LOADINGS

	1986 LOADING Kg/Day	1986 NO. OF SAMPLES	1987 LOADING Kg/Day	1987 NO. OF SAMPLES	1988 LOADING Kg/Day	1988 NO. OF SAMPLES	1989 LOADING Kg/Day	1989 NO. OF SAMPLES	1990 LOADING Kg/Day	1990 NO. OF SAMPLES	1991 LOADING Kg/Day	1991 NO. OF SAMPLES	1992 LOADING Kg/Day	1992 NO. OF SAMPLES
Arsenic	0	0/1	0	0/1	0	0/5	0	0/14	0	0/12	0	0/20	0	0/8
Mercury*	0	0/2	0	0/3	0	0/6	0	0/14	0	0/12	0	0/20	0	0/8
Lead	0	0/3	0	0/4	0	0/5	0.23	7/14	0.29	10/12	0.041	6/20	0.046	3/8
Benz(a)anthracene*	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Benzo(a)pyrene*	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Benzo(b)fluoranthene*	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0.0025	1/8
Benzo(k)fluoranthene*	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Chrysene	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Tetrachloroethylene*	not analyzed		0	0/2	0	0/6	0	0/11	0	0/11	0	0/20	0	0/8
Octachlorostyrene	not analyzed		not analyzed		not analyzed		0	0/8	0	0/8	0	0/20	0	0/8
Hexachlorobenzene*	not analyzed		not analyzed		not analyzed		0	0/8	0	0/8	0	0/20	0	0/8
PCBs*	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Mirex*	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Alpha Chlordane	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Gamma Chlordane	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Oxychlordane	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Dieldrin	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
Toxaphene	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
DDT-p	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
DDT-o	not analyzed		not analyzed		not analyzed		not analyzed		not analyzed		0	0/20	0	0/8
TOTAL	0		0		0		0.23		0.29		0.041		0.0485	
% Reduction Since 1986														
TOTAL*	0		0		0		0		0		0		0.0025	
% Reduction Since 1986														

* Chemicals targeted for a 50% reduction by 1996

DETECTS/SAMPLES – The Number of times a compound was detected/The Number of samples taken for that parameter.

TABLE 17: FORT ERIE WPCP TOTAL LOADINGS OF THE 18 CHEMICALS OF CONCERN

	1986 LOADING Kg/Day	1986 DETECTS/ SAMPLES	1987 LOADING Kg/Day	1987 DETECTS/ SAMPLES	1988 LOADING Kg/Day	1988 DETECTS/ SAMPLES	1989 LOADING Kg/Day	1989 DETECTS/ SAMPLES	1990 LOADING Kg/Day	1990 DETECTS/ SAMPLES	1991 LOADING Kg/Day	1991 DETECTS/ SAMPLES	1992 LOADING Kg/Day	1992 DETECTS/ SAMPLES
Arsenic	0.34	4/4	0.39	5/5	0	0/6	0	0/13	0	0/9	0	0/10	0	0/4
Mercury*	0.022	4/4	0.004	5/5	0.003	6/6	0.004	7/13	0.008	1/9	0	0/10	0	0/4
Lead	1.7	4/4	0.37	5/5	0.16	5/6	0.25	9/13	0.56	9/9	0.1	6/10	0.39	4/4
Benz(a)anthracene*	not analyzed		0	0/10	0	0/6	0	0/9	0	0/9	0	0/10	0	0/4
Benzo(a)pyrene*	not analyzed		0	0/10	0	0/6	0	0/9	0	0/9	0	0/10	0	0/4
Benzo(b)fluoranthene*	not analyzed		not analyzed		not analyzed		0	0/9	0	0/9	0	0/10	0	0/4
Benzo(k)fluoranthene*	not analyzed		not analyzed		0	0/6	0	0/9	0	0/9	0	0/10	0	0/4
Chrysene	not analyzed		0	0/10	0	0/9	0	0/9	0	0/9	0	0/10	0	0/4
Tetrachloroethylene*	0	0/3	0	0/10	0	0/9	0	0/8	0.092	2/8	0	0/10	0	0/4
Octachlorostyrene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/9	0	0/10	0	0/4
Hexachlorobenzene*	0	0/3	not analyzed		0	0/9	0	0/11	0	0/9	0	0/10	0	0/4
PCBs*	0	0/3	0	0/9	0	0/9	0	0/11	0	0/9	0	0/10	0	0/4
Mirex*	0	0/3	0	0/9	0	0/9	0	0/11	0	0/9	0	0/10	0	0/4
Alpha Chlordane	0	0/3	0	0/9	0.00005	1/9	0.0004	2/11	0	0/9	0	0/10	0	0/4
Gamma Chlordane	0	0/3	0	0/9	0.00006	1/9	0	0/11	0	0/9	0	0/10	0	0/4
Oxychlordane	0	0/3	0	0/9	0	0/9	0	0/11	0	0/9	0	0/10	0	0/4
Dieldrin	0	0/3	0	0/9	0	0/9	0	0/11	0	0/9	0	0/10	0	0/4
Toxaphene	not analyzed		not analyzed		not analyzed		not analyzed		0	0/9	0	0/10	0	0/4
DDT-p	0	0/3	0	0/9	0	0/9	0	0/11	0	0/9	0	0/10	0	0/4
DDT-o	0	0/3	0	0/9	0	0/9	0	0/11	0	0/9	0	0/10	0	0/4
TOTAL	2.062		0.764		0.16311		0.2544		0.66		0.1		0.39	
% Reduction Since 1986			62.9		92.1		87.7		68.0		98.3		81.1	
TOTAL *	0.022		0.004		0.003		0.004		0.1		0		0	
% Reduction Since 1986			81.8		86.4		81.8		+354.5		100.0		100.0	

* Chemicals Targeted for 50 % Reduction by 1996
Detects/Samples – The number of times a parmeter was detected / number of samples taken for that parameter

TABLE 18: MCMASTER AVE CSO TOTAL LOADINGS OF THE 18 CHEMICALS OF CONCERN

	1986 LOADING Kg/Day	1986 DETECTS/ SAMPLES	1987 LOADING Kg/Day	1987 DETECTS/ SAMPLES	1988 LOADING Kg/Day	1988 DETECTS/ SAMPLES	1989
Arsenic	0.15	1/1	0.15	5/5	0	0/3	Discharge directed to Welland WPCP.
Mercury*	0.003	2/2	0.002	5/5	0.002	2/3	
Lead	0.68	3/3	0.53	5/5	0.5	2/3	
Benz(a)anthracene*	not analyzed		0	0/1	not analyzed		
Benzo(a)pyrene*	not analyzed		0	0/1	not analyzed		
Benzo(b)fluoranthene*	not analyzed		not analyzed		not analyzed		
Benzo(k)fluoranthene*	not analyzed		0	0/1	not analyzed		
Chrysene	not analyzed		0	0/1		0/2	
Tetrachloroethylene*	not analyzed		0	0/1		0/3	
Octachlorostyrene	not analyzed		not analyzed			0/3	
Hexachlorobenzene*	0	0/2	0	0/8		0/3	
PCBs*	0	0/2	0	0/8		0/3	
Mirex*	0	0/2	0	0/8		0/3	
Alpha Chlordane	0	0/2	0	0/2		0/3	
Gamma Chlordane	0	0/2	0	0/2		0/3	
Oxychlordane	0	0/2	0	0/4		0/3	
Dieldrin	0	0/2	0	0/5		0/3	
Toxaphene	not analyzed		not analyzed		not analyzed		
DDT-p	0	0/2	0	0/3		0/3	
DDT-o	0	0/2	0	0/3		0/3	
TOTAL	0.833		0.682		0.502		0
% Reduction Since 1986			18.1		39.7		100.0
TOTAL *	0		0		0		0
% Reduction Since 1986			0.0		0.0		0.0

* Chemicals Targeted for 50 % Reduction by 1996
Detects/Samples – The number of times a parmeter was detected / number of samples taken for that parmeter

TABLE 19: NIAGARA FALLS WPCP TOTAL LOADINGS OF THE 18 CHEMICALS OF CONCERN

	1986 LOADING Kg/Day	DETECTS/ SAMPLES	1987 LOADING Kg/Day	DETECTS/ SAMPLES	1988 LOADING Kg/Day	DETECTS/ SAMPLES	1989 LOADING Kg/Day	DETECTS/ SAMPLES	1990 LOADING Kg/Day	DETECTS/ SAMPLES	1991 LOADING Kg/Day	DETECTS/ SAMPLES	1992 LOADING Kg/Day	DETECTS/ SAMPLES
Arsenic	1.07	9/9	1.83	4/4	0	0/4	0	0/8	0	0/13	0.03	1/10	0	0/4
Mercury*	0.009	9/9	0.016	4/4	0.01	3/7	0.012	8/8	0.13	5/13	0.002	7/10	0.00125	1/4
Lead	3.6	9/9	1.84	4/4	0	0/4	0.62	4/8	1.2	12/13	0.39	7/10	0.69	2/4
Benz(a)anthracene*	0	0/2	0	0/3	0	0/4	0	0/8	0	0/13	0	0/10	0	0/4
Benzo(a)pyrene*	0	0/2	0	0/3	0	0/4	0	0/8	0	0/13	0	0/10	0	0/4
Benzo(b)fluoranthene*	0	0/2	0	0/3	0	0/4	0	0/8	0	0/7	0	0/10	0	0/4
Benzo(k)fluoranthene*	0	0/2	0	0/3	0	0/4	0	0/8	0	0/13	0	0/10	0	0/4
Chrysene	0	0/2	0	0/3	0	0/4	0	0/8	0	0/13	0	0/10	0	0/4
Tetrachloroethylene*	1.2	2/4	0	0/3	0.42	2/4	0.04	2/8	0	0/13	0.0021	1/10	0.035	1/4
Octachlorostyrene	0	0/2	not analyzed		not analyzed		not analyzed		0	0/13	0	0/10	0.000068	1/4
Hexachlorobenzene*	0	0/6	0.002	3/4	0	0/4	0	0/8	0	0/13	0	0/10	0	0/4
PCBs*	0.073	2/6	0	0/4	0	0/4	0	0/7	0	0/13	0	0/10	0	0/4
Mirex*	0	0/6	0	0/4	0	0/4	0	0/8	0	0/13	0	0/10	0	0/4
Alpha Chlordane	0	0/6	0	0/4	0	0/4	0	0/8	0	0/13	0	0/10	0	0/4
Gamma Chlordane	0	0/6	0	0/4	0.003	1/4	0	0/8	0	0/13	0	0/10	0	0/4
Oxychlordane	0	0/6	0	0/4	0	0/4	0	0/8	0	0/13	0	0/10	0	0/4
Dieldrin	0.001	1/6	0	0/4	0	0/4	0	0/8	0	0/13	0	0/10	0	0/4
Toxaphene	not analyzed		not analyzed		not analyzed		0	0/8	0	0/13	0	0/10	0	0/4
DDT−p	0	0/6	0	0/4	0	0/4	0	0/8	0	0/13	0	0/10	0	0/4
DDT−o	0	0/6	0	0/4	0	0/4	0	0/8	0	0/13	0	0/10	0	0/4
TOTAL	5.953		3.688		0.433		0.672		1.33		0.4241		0.726318	
% Reduction Since 1986			38.0		92.7		88.7		77.7		92.9		87.8	
TOTAL *	1.282		0.018		0.43		0.052		0.13		0.0041		0.03625	
% Reduction Since 1986			98.6		66.5		95.9		89.9		99.7		97.2	

* Chemicals Targeted for 50 % Reduction by 1996

Detects/Samples − The number of times a parmeter was detected / number of samples taken for that parameter

TABLE 20: PORT ROBINSON LAGOONS – TOTAL LOADINGS
(FACILITY COMMISSIONED 1990)

	1990 LOADING Kg/Day	DETECTS/ SAMPLES	1991 LOADING Kg/Day	DETECTS/ SAMPLES	1992 LOADING Kg/Day	DETECTS/ SAMPLES
Arsenic	0	0/7	0.0001	2/10	0.00058	3/4
Mercury*	0	0/7	0	0/10	0.0043	1/4
Lead	0.03	6/7	0.003	6/10	0.0235	4/4
Benz(a)anthracene*	0	0/1	0	0/10	0	0/4
Benzo(a)pyrene*	0	0/1	0	0/10	0	0/4
Benzo(b)fluoranthene*	0	0/1	0	0/10	0	0/4
Benzo(k)fluoranthene*	0	0/1	0	0/10	0	0/4
Chrysene	0	0/1	0	0/10	0	0/4
Tetrachloroethylene*	0	0/1	0	0/10	0	0/4
Octachlorostyrene	0	0/1	0	0/10	0	0/4
Hexachlorobenzene*	0	0/7	0	0/10	0	0/4
PCBs*	0	0/7	0	0/10	0	0/4
Mirex*	0	0/7	0	0/10	0	0/4
Alpha Chlordane	0	0/7	0	0/10	0	0/4
Gamma Chlordane	0	0/7	0	0/10	0	0/4
Oxychlordane	0	0/7	0	0/10	0	0/4
Dieldrin	0	0/7	0	0/10	0	0/4
Toxaphene	0	0/7	0	0/10	0	0/4
DDT–p	0	0/7	0	0/10	0	0/4
DDT–o	0	0/7	0	0/10	0	0/4
TOTAL	0.03		0.0031		0.02838	
% Reduction Since 1990			89.7		5.4	
TOTAL *	0		0		0	
% Reduction Since Commissioned			0.0		0.0	

* Chemicals Targeted for 50 % Reduction by 1996
Detects/Samples – The number of times a parmeter was detected / number of samples taken for that parmeter

TABLE 21: QUEENSTON WPCP TOTAL LOADINGS
(FACILITY COMMISSIONED 1990)

	1990 LOADING Kg/Day	DETECTS/ SAMPLES	1991 LOADING Kg/Day	DETECTS/ SAMPLES	1992 LOADING Kg/Day	DETECTS/ SAMPLES
Arsenic	0	0/1	0.0002	1/10	0	0/4
Mercury*	0.001	1/1	2.0E-06	1/10	0	0/4
Lead	0.002	1/1	0.001	7/10	0.0026	2/4
Benz(a)anthracene*	0	0/1	0	0/10	0	0/4
Benzo(a)pyrene*	0	0/1	0	0/10	0	0/4
Benzo(b)fluoranthene*	0	0/1	0	0/10	0	0/4
Benzo(k)fluoranthene*	0	0/1	0	0/10	0	0/4
Chrysene	0	0/1	0	0/10	0	0/4
Tetrachloroethylene*	0	0/1	0.00005	1/10	0.0001	1/4
Octachlorostyrene	0	0/1	0	0/10	0	0/4
Hexachlorobenzene*	0	0/1	0	0/10	0	0/4
PCBs*	0	0/1	0	0/10	0	0/4
Mirex*	0	0/1	0	0/10	0	0/4
Alpha Chlordane	0	0/1	0	0/10	0	0/4
Gamma Chlordane	0.00002	1/1	0	0/10	0	0/4
Oxychlordane	0	0/1	0	0/10	0	0/4
Dieldrin	0	0/1	0	0/10	0	0/4
Toxaphene	not analyzed		0	0/10	0	0/4
DDT-p	0	0/1	0	0/10	0	0/4
DDT-o	0	0/1	0	0/10	0	0/4
TOTAL	0.00302		0.001252		0.0027	
% Reduction Since 1990			58.5		10.6	
TOTAL *	0		0		0	
% Reduction Since Commissioned						

* Chemicals Targeted for 50 % Reduction by 1996

Detects/Samples – The number of times a parmeter was detected / number of samples taken for that parmeter

TABLE 22: STANLEY AVE. CSO TOTAL LOADINGS OF THE 18 CHEMICALS OF CONCERN

	1988 LOADING Kg/Day	DETECTS/ SAMPLES	1989 LOADING Kg/Day	DETECTS/ SAMPLES	1990 LOADING Kg/Day	DETECTS/ SAMPLES	1991 LOADING Kg/Day	DETECTS/ SAMPLES	1992 LOADING Kg/Day	DETECTS/ SAMPLES
Arsenic	0	0/3	0.01	1/4	0	0/6	0.004	3/10	0.01	2/4
Mercury*	0	0/3	0.003	2/4	0	0/6	0.002	1/10	0	0/4
Lead	0	0/3	0.43	4/4	0.03	1/6	0.16	9/10	0.09	4/4
Benz(a)anthracene*	0	0/2	0	0/4	0	0/6	0	0/10	0	0/4
Benzo(a)pyrene*	0	0/2	0	0/4	0	0/6	0	0/10	0	0/4
Benzo(b)fluoranthene*	0	0/2	0	0/4	0	0/6	0.03	1/10	0	0/4
Benzo(k)fluoranthene*	0	0/2	0	0/4	0	0/6	0	0/10	0	0/4
Chrysene	0	0/2	0	0/4	0	0/6	0	0/10	0	0/4
Tetrachloroethylene*	0.38	2/3	0	0/4	0.72	3/6	0.03	2/10	0	0/4
Octachlorostyrene	not analyzed		not analyzed		0	0/6	0	0/10	0	0/4
Hexachlorobenzene*	0	0/2	0	0/4	0	0/6	0	0/10	0	0/4
PCBs*	0	0/2	0	0/4	not analyzed		0	0/10	0	0/4
Mirex*	0	0/2	0	0/4	not analyzed		0	0/10	0	0/4
Alpha Chlordane	0	0/2	0	0/4	not analyzed		0	0/10	0	0/4
Gamma Chlordane	0	0/2	0	0/4	not analyzed		0	0/10	0	0/4
Oxychlordane	0	0/2	0	0/4	not analyzed		0	0/10	0	0/4
Dieldrin	0	0/2	0	0/4	not analyzed		0	0/10	0	0/4
Toxaphene	not analyzed		not analyzed		not analyzed		0	0/10	0	0/4
DDT−p	0	0/2	0	0/4	not analyzed		0	0/10	0	0/4
DDT−o	0	0/2	0	0/4	not analyzed		0	0/10	0	0/4
TOTAL	0.38		0.443		0.75		0.226		0.1	
% Reduction Since 1988			+16.6		+97.4		40.5		73.7	
TOTAL *	0.38		0.003		0.72		0.062		0	
% Reduction Since 1990			99.2		+89.4757		83.7		100.0	

* Chemicals Targeted for 50 % Reduction by 1996
Detects/Samples − The number of times a parmeter was detected / number of samples taken for that parmeter

TABLE 23: STEVENSVILLE–DOUGLASTOWN LAGOONS TOTAL LOADINGS
(FACILITY COMMISSIONED 1989)

	1989 LOADING Kg/Day	DETECTS/ SAMPLES	1990 LOADING Kg/Day	DETECTS/ SAMPLES	1991 LOADING Kg/Day	DETECTS/ SAMPLES	1992 LOADING Kg/Day	DETECTS/ SAMPLES
Arsenic	0.002	3/3	0.005	3/7	0.0002	3/10	0.0009	3/4
Mercury*	0	0/3	0	0/7	0	0/10	0	0/4
Lead	0	0/3	0.03	7/7	0.007	7/10	0.035	3/4
Benz(a)anthracene*	0	0/3	0	0/7	0	0/10	0	0/4
Benzo(a)pyrene*	0	0/3	0	0/7	0	0/10	0	0/4
Benzo(b)fluoranthene*	0	0/3	0	0/7	0	0/10	0	0/4
Benzo(k)fluoranthene*	0	0/3	0	0/7	0	0/10	0	0/4
Chrysene	0	0/3	0	0/7	0	0/10	0	0/4
Tetrachloroethylene*	not analyzed		0	0/7	0	0/9	0	0/4
Octachlorostyrene	not analyzed		0	0/7	0	0/10	0	0/4
Hexachlorobenzene*	0	0/3	0	0/7	0	0/10	0	0/4
PCBs*	0	0/3	0	0/7	0	0/10	0	0/4
Mirex*	0	0/3	0	0/7	0	0/10	0	0/4
Alpha Chlordane	0	0/3	0	0/7	0	0/10	0	0/4
Gamma Chlordane	0	0/3	0	0/7	2.0E–06	1/10	8.0E–06	1/4
Oxychlordane	0	0/3	0	0/7	0	0/10	0	0/4
Dieldrin	0	0/3	0	0/7	0	0/10	0	0/4
Toxaphene	0	0/3	0	0/7	0	0/10	0	0/4
DDT–p	0	0/3	0	0/7	0	0/10	0	0/4
DDT–o	0	0/3	0	0/7	0	0/10	0	0/4
TOTAL	0.002		0.035		0.007202		0.035908	
% Reduction Since 1989			+1650		+260.1		1695.0	
TOTAL *	0		0		0		0	
% Reduction Since Commissioned								

* Chemicals Targeted for 50 % Reduction by 1996
Detects/Samples – The number of times a parmeter was detected / number of samples taken for that parmeter

TABLE 24: WELLAND WPCP TOTAL LOADINGS OF THE 18 CHEMICALS OF CONCERN

	1986 LOADING Kg/Day	DETECTS/ SAMPLES	1987 LOADING Kg/Day	DETECTS/ SAMPLES	1988 LOADING Kg/Day	DETECTS/ SAMPLES	1989 LOADING Kg/Day	DETECTS/ SAMPLES	1990 LOADING Kg/Day	DETECTS/ SAMPLES	1991 LOADING Kg/Day	DETECTS/ SAMPLES	1992 LOADING Kg/Day	DETECTS/ SAMPLES
Arsenic	0.78	7/7	0.59	3/3	0	0/3	0	0/5	0	0/15	0.02	1/10	0	0/4
Mercury*	0.053	7/7	0.016	2/3	0	0/3	0.001	2/5	0.0007	1/15	0	0/10	0.0015	1/4
Lead	0.71	7/7	0.59	3/3	0	0/3	0.11	5/5	0.46	11/15	0.3	7/10	0.47	2/4
Benz(a)anthracene*	0	0/2	0	0/2	0	0/3	0	0/3	0	0/13	0	0/10	0	0/4
Benzo(a)pyrene*	0	0/2	0	0/2	0	0/3	0	0/3	0	0/13	0	0/10	0	0/4
Benzo(b)fluoranthene*	0	0/2	0	0/3	0	0/3	0	0/3	0	0/13	0	0/9	0	0/4
Benzo(k)fluoranthene*	0	0/2	0	0/3	0	0/3	0	0/3	0	0/13	0	0/10	0	0/4
Chrysene	0	0/2	0	0/3	0	0/3	0	0/3	0	0/13	0	0/10	0	0/4
Tetrachloroethylene*	0.16	3/5	0	0/3	0	0/3	0	0/3	0	0/13	0	0/10	0.049	2/4
Octachlorostyrene	0	0/5	0	0/3	0	0/3	not analyzed		0	0/15	0	0/10	0	0/4
Hexachlorobenzene*	0	0/5	0	0/3	0	0/3	0	0/6	0	0/15	0	0/10	0	0/4
PCBs*	0	0/5	0	0/3	0	0/3	0	0/5	0	0/15	0	0/10	0	0/4
Mirex*	0	0/5	0	0/3	0	0/3	0	0/5	0	0/15	0	0/10	0	0/4
Alpha Chlordane	0	0/5	0	0/3	0	0/3	0	0/5	0	0/15	0	0/10	0	0/4
Gamma Chlordane	0	0/5	0	0/3	0.0025	3/3	0	0/5	0	0/15	0	0/10	0	0/4
Oxychlordane	0	0/5	0	0/3	0	0/3	0	0/5	0	0/15	0	0/10	0	0/4
Dieldrin	0	0/5	0	0/3	0	0/3	0	0/5	0	0/15	0	0/10	0	0/4
Toxaphene	0	0/5	0	0/3	0	0/3	not analyzed		0	0/9	0	0/10	0	0/4
DDT−p	0	0/5	0	0/3	0	0/3	0	0/5	0	0/15	0	0/10	0	0/4
DDT−o	0	0/5	0	0/3	0	0/3	0	0/5	0	0/15	0	0/10	0	0/4
TOTAL	1.703		1.196		0.0025		0.111		0.4607		0.32		0.5205	
% Reduction Since 1986			29.8		99.9		93.5		72.9		81.2		69.4	
TOTAL *	0.213		0.016		0		0.001		0.0007		0		0.0505	
% Reduction Since 1986			92.5		100.0		99.5		99.7		100.0		76.3	

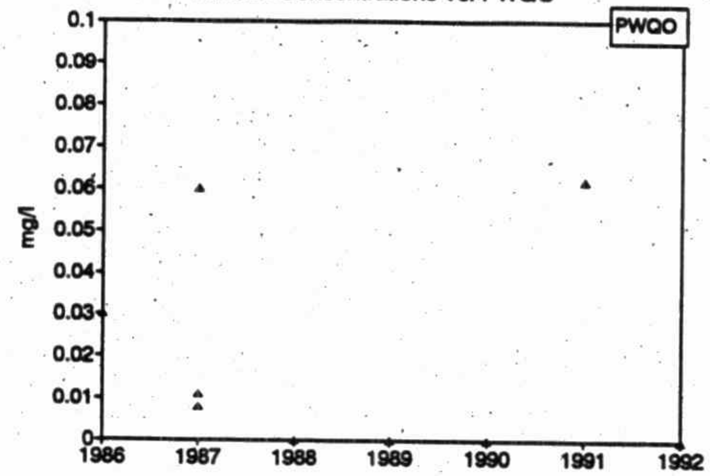
* Chemicals Targeted for 50 % Reduction by 1996

Detects/Samples – The number of times a parmeter was detected / number of samples taken for that parameter

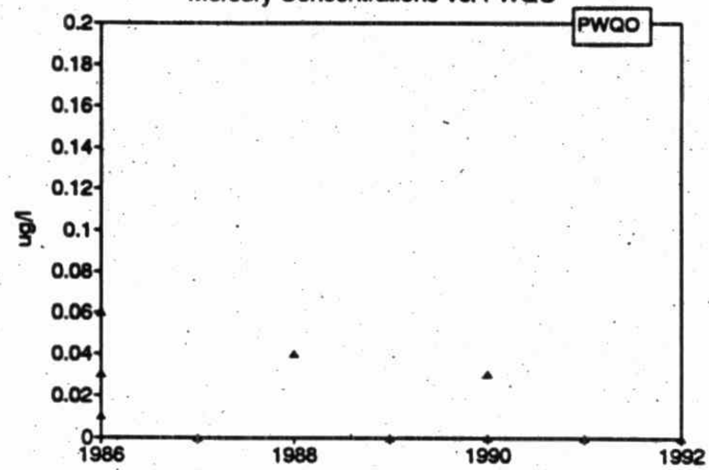
APPENDIX C

METALS CONCENTRATIONS VS. PWQOs

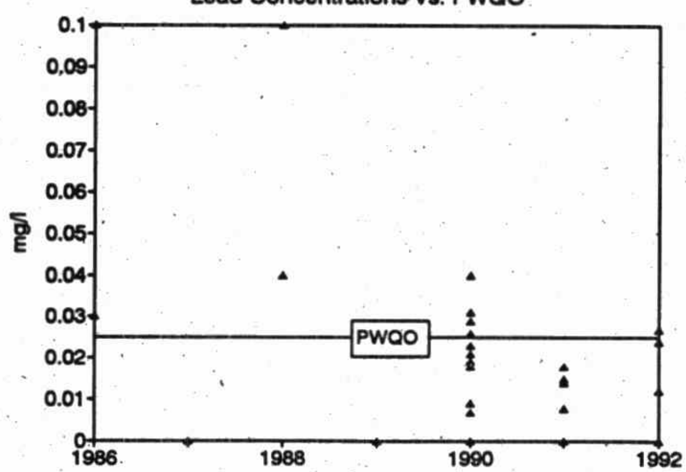
Atlas Specialty Steels
Arsenic Concentrations Vs. PWQO

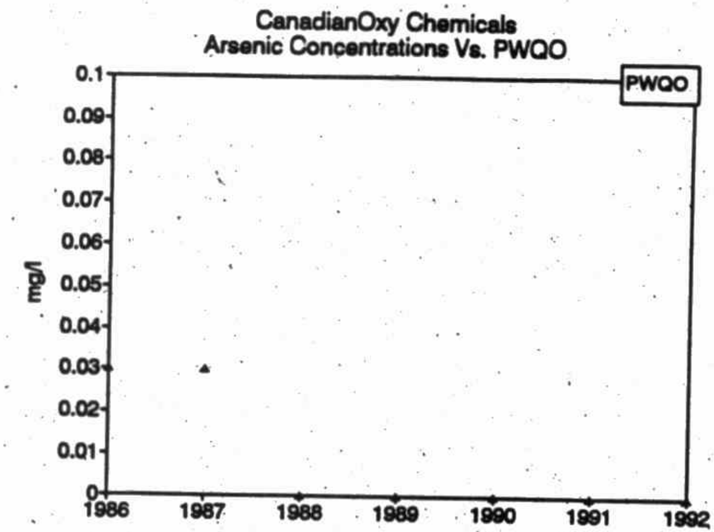


Atlas Specialty Steels
Mercury Concentrations Vs. PWQO



Atlas Specialty Steels
Lead Concentrations Vs. PWQO




CanadianOxy Chemicals
Arsenic Concentrations Vs. PWQO
PWQO
mg/l
0.1
0.09
0.08
0.07
0.06
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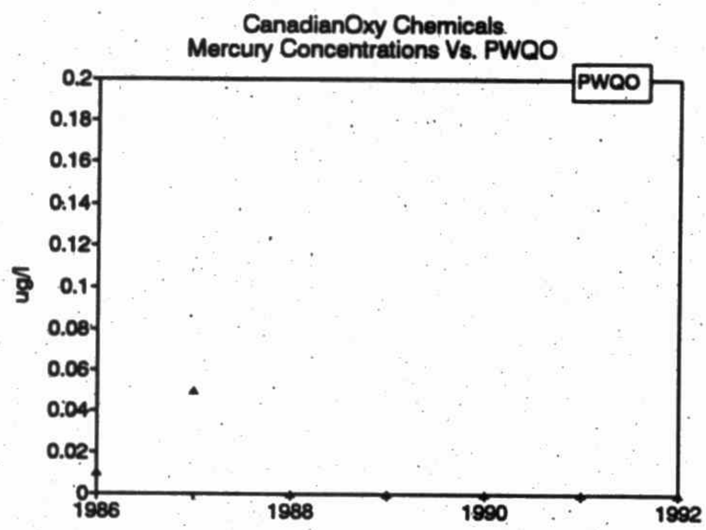
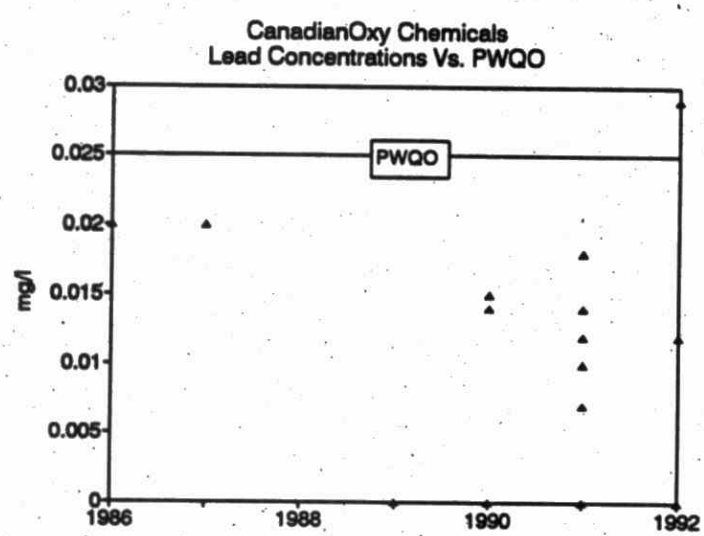
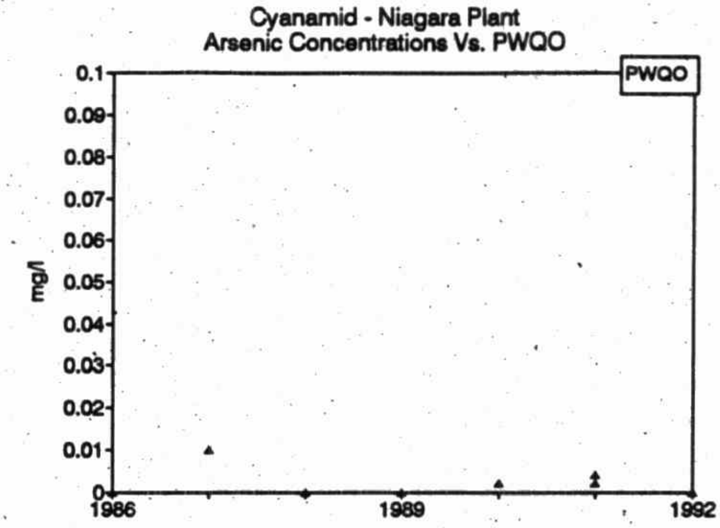
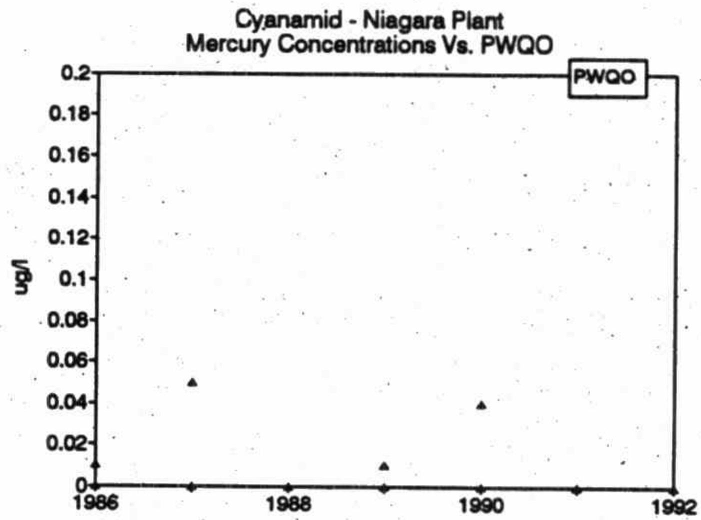
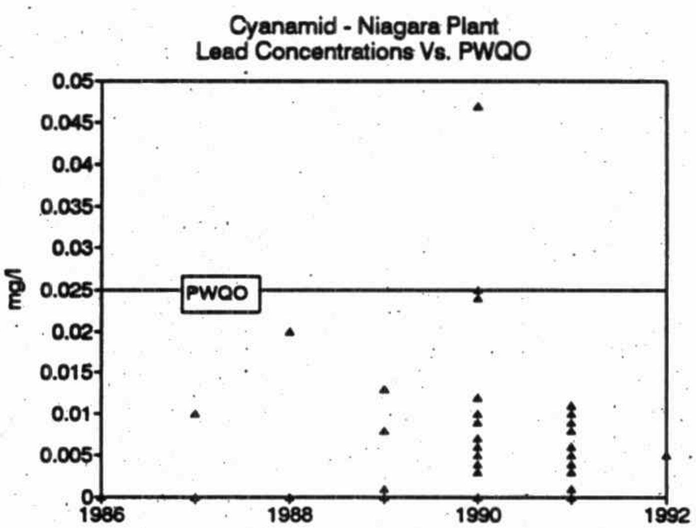
0.04
0.03
0.02
0.01
0
1986
1987
1988
1989
1990
1991
1992

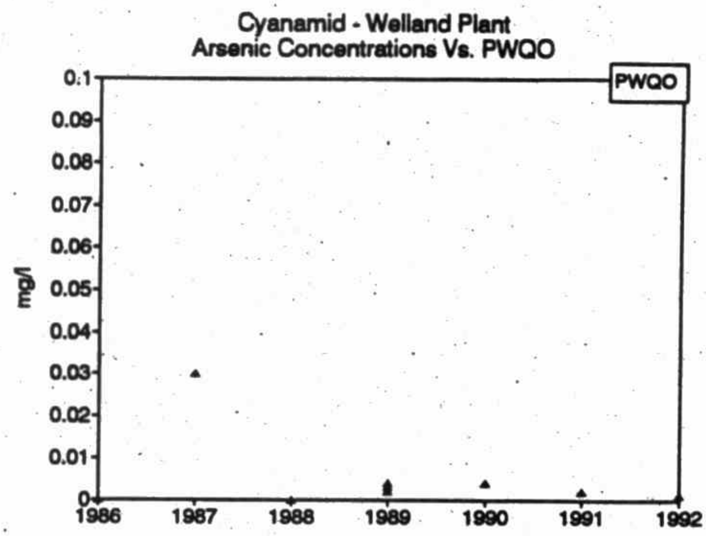

CanadianOxy Chemicals
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1986
1988
1990
1992

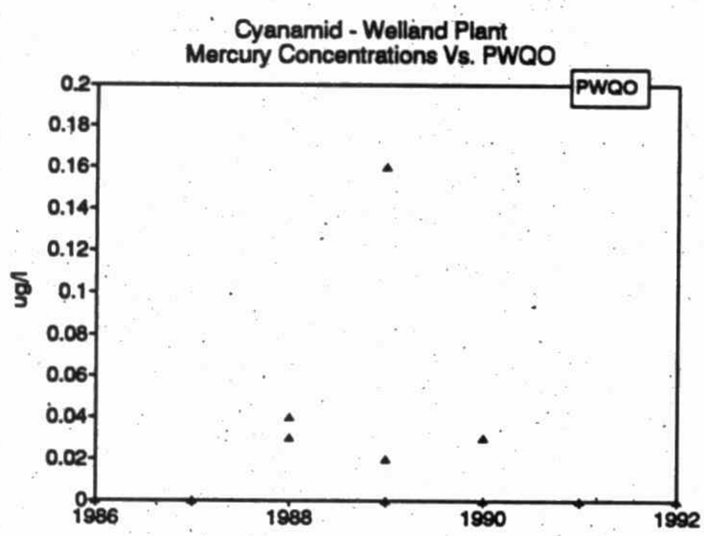

CanadianOxy Chemicals
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.03
0.025
0.02
0.015
0.01
0.005
0
1986
1988
1990
1992

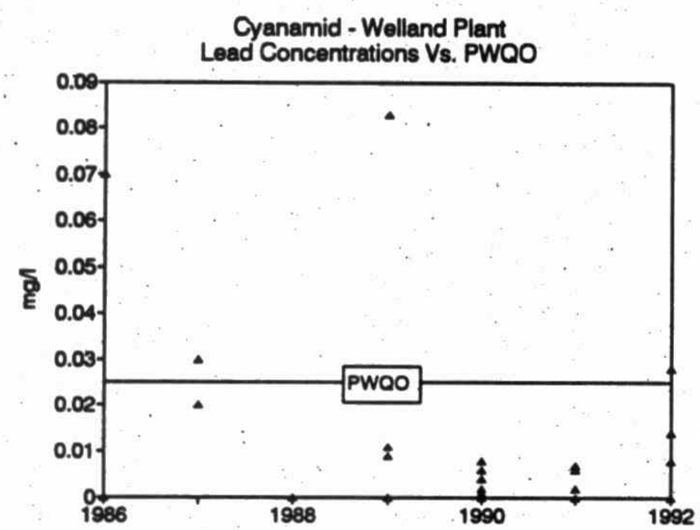

Cyanamid - Niagara Plant
Arsenic Concentrations Vs. PWQO
PWQO
mg/l
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1989
1992

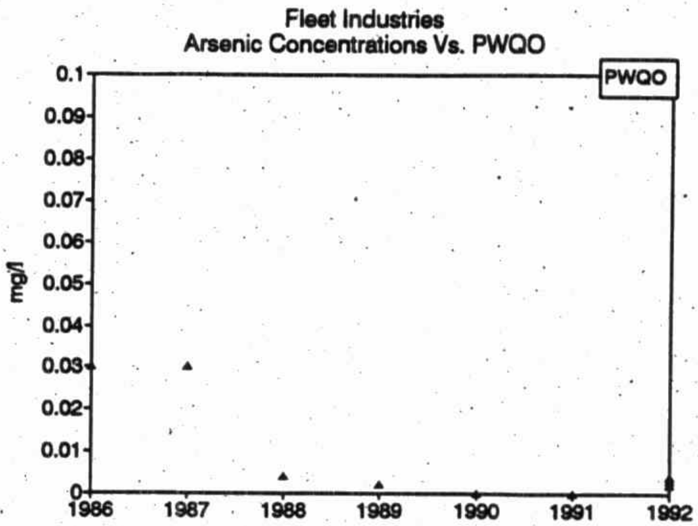

Cyanamid - Niagara Plant
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1986
1988
1990
1992

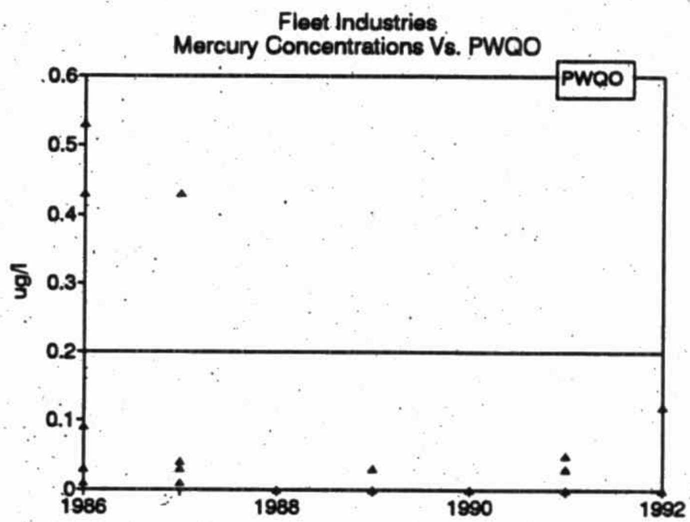

Cyanamid - Niagara Plant
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
1986
1988
1990
1992

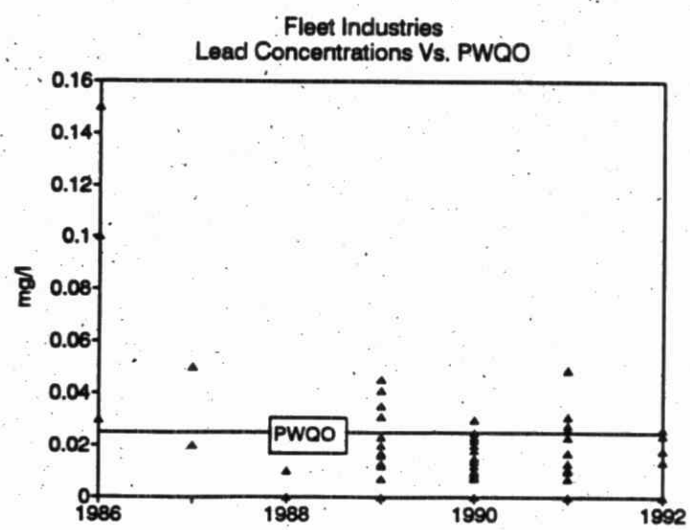

Cyanamid - Welland Plant
Arsenic Concentrations Vs. PWQO
PWQO
mg/l
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1987
1988
1989
1990
1991
1992


Cyanamid - Welland Plant
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1986
1988
1990
1992

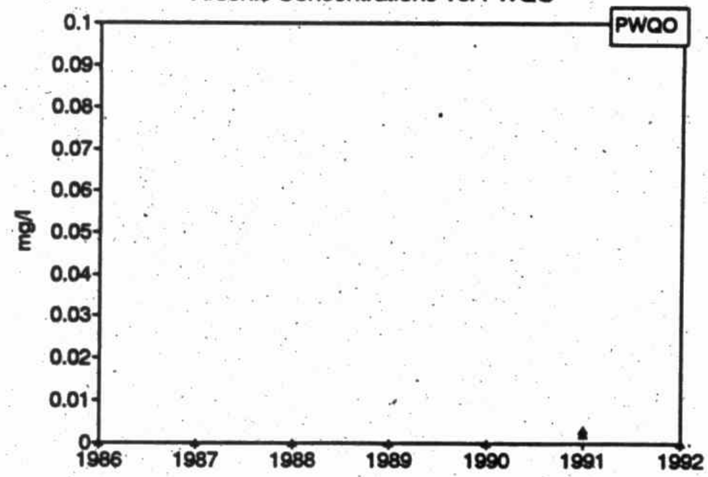

Cyanamid - Welland Plant
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1988
1990
1992


Fleet Industries
Arsenic Concentrations Vs. PWQO
PWQO
mg/l
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1987
1988
1989
1990
1991
1992

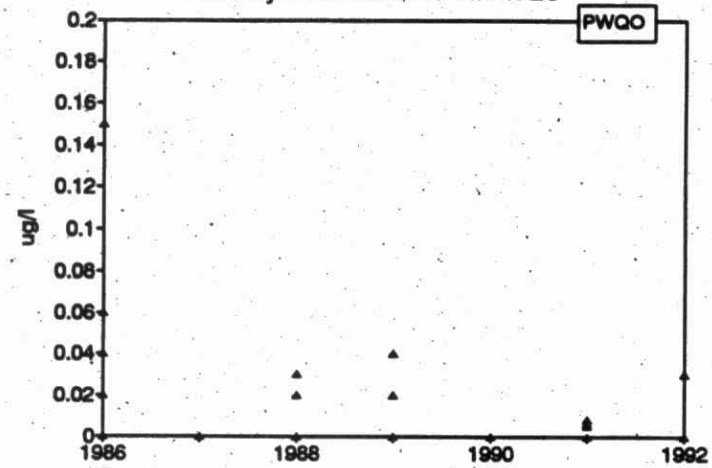

Fleet Industries
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.6
0.5
0.4
0.3
0.2
0.1
0
1986
1988
1990
1992


Fleet Industries
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1986
1988
1990
1992

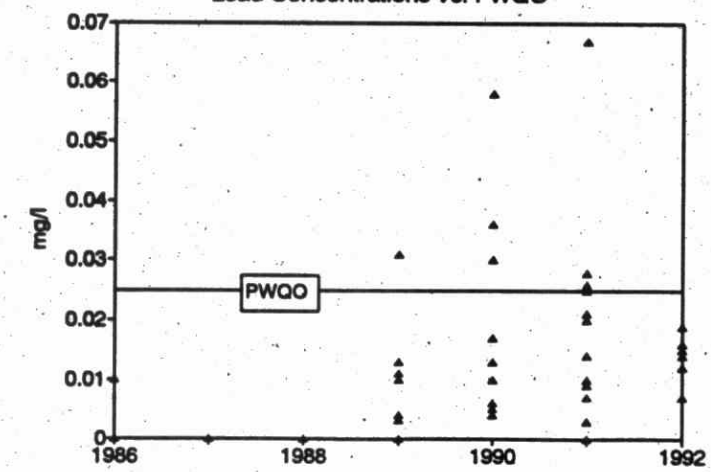
Ford - Niagara Glass Plant
Arsenic Concentrations Vs. PWQO

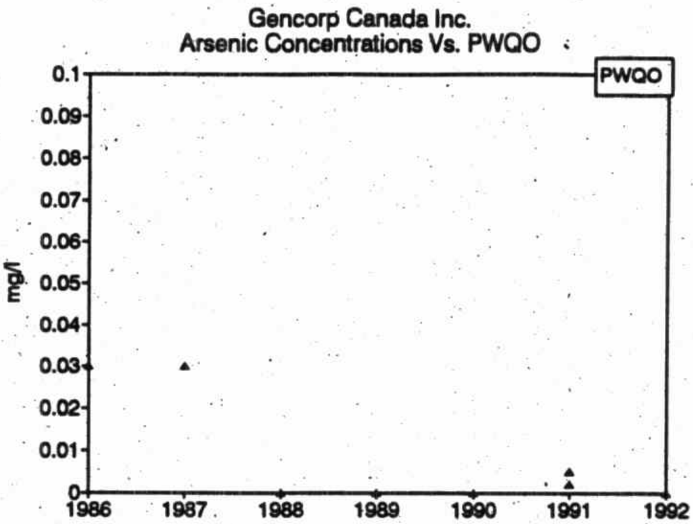


Ford - Niagara Glass Plant
Mercury Concentrations Vs. PWQO

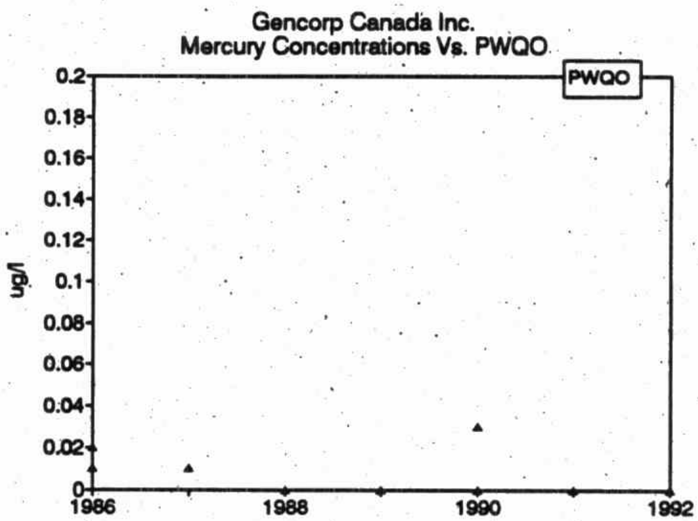


Ford - Niagara Glass Plant
Lead Concentrations Vs. PWQO

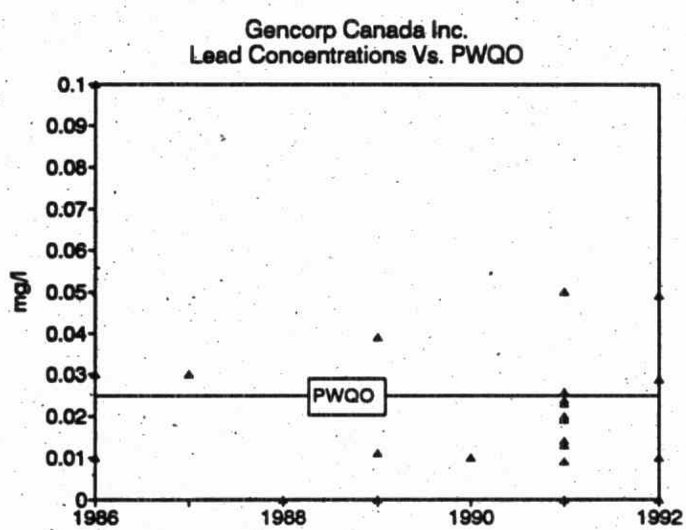




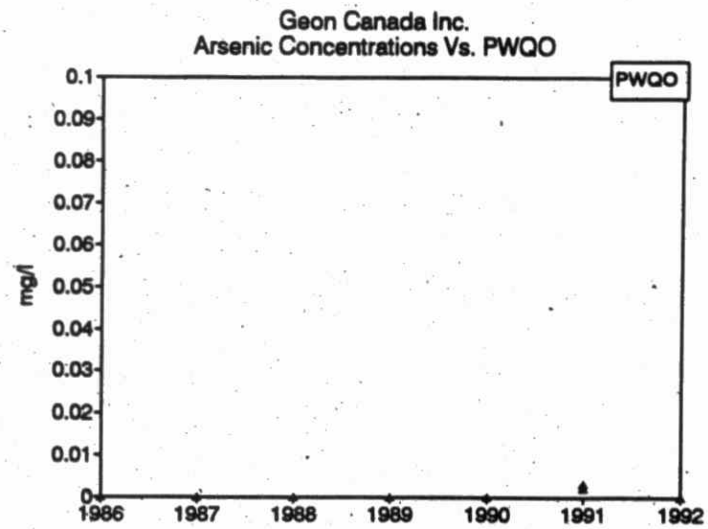
Gencorp Canada Inc.
Arsenic Concentrations Vs. PWQO
PWQO
mg/l
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1987
1988
1989
1990
1991
1992

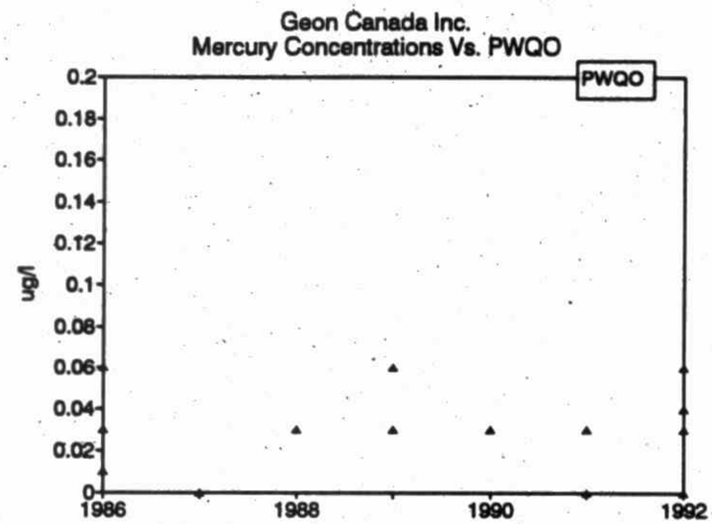


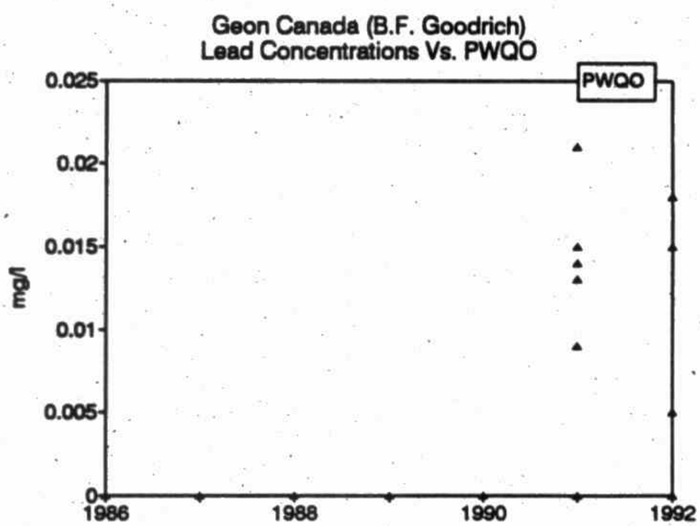
Gencorp Canada Inc.
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1986
1988
1990
1992



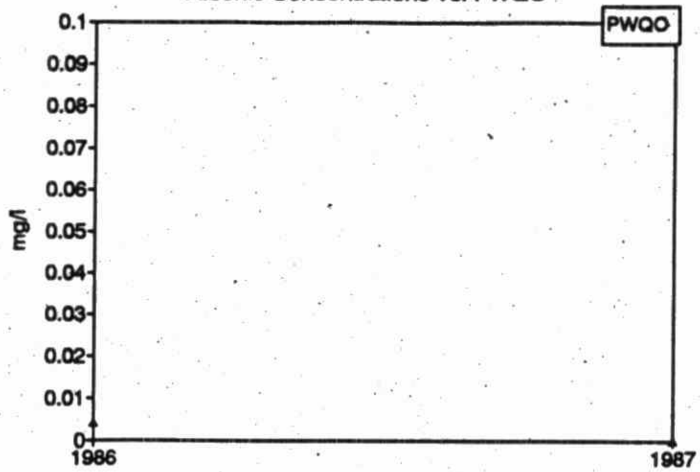
Gencorp Canada Inc.
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1988
1990
1992


Geon Canada Inc.
Arsenic Concentrations Vs. PWQO
PWQO
mg/l
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1987
1988
1989
1990
1991
1992

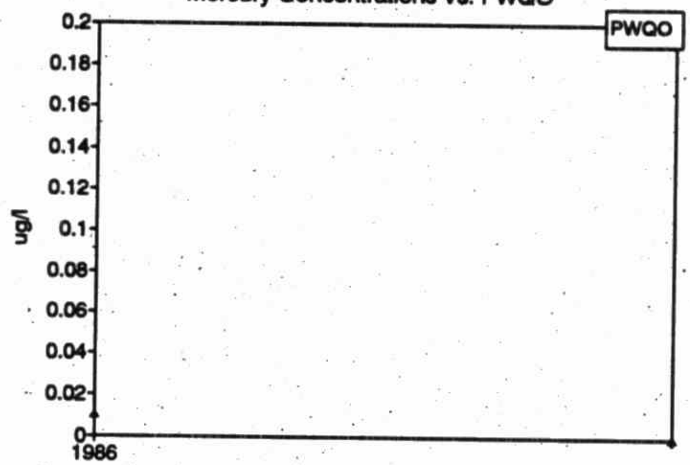

Geon Canada Inc.
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1986
1988
1990
1992


Geon Canada (B.F. Goodrich)
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.025
0.02
0.015
0.01
0.005
0
1986
1988
1990
1992

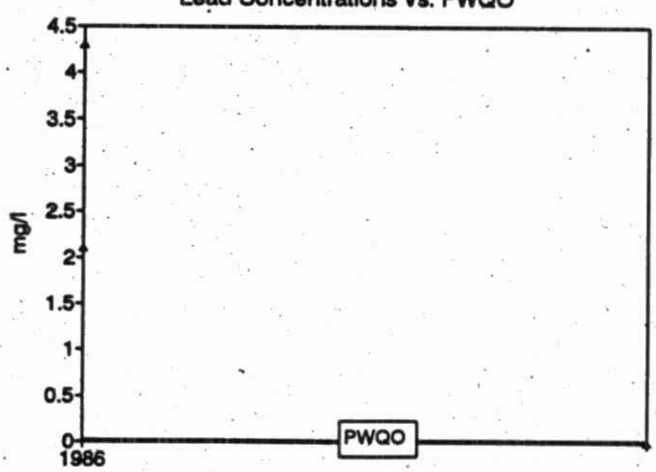
Gould National Battery
Arsenic Concentrations Vs. PWQO

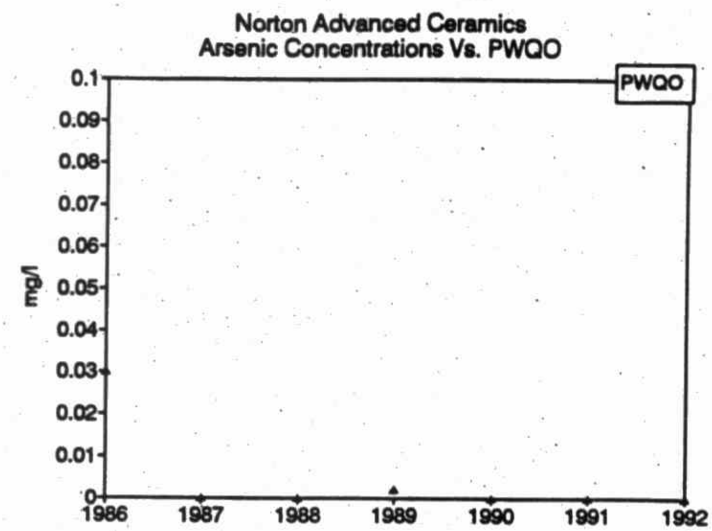


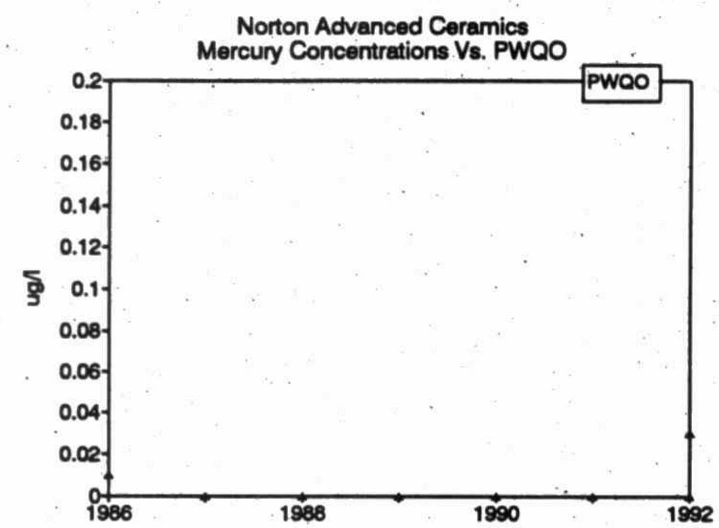
Gould National Battery
Mercury Concentrations Vs. PWQO

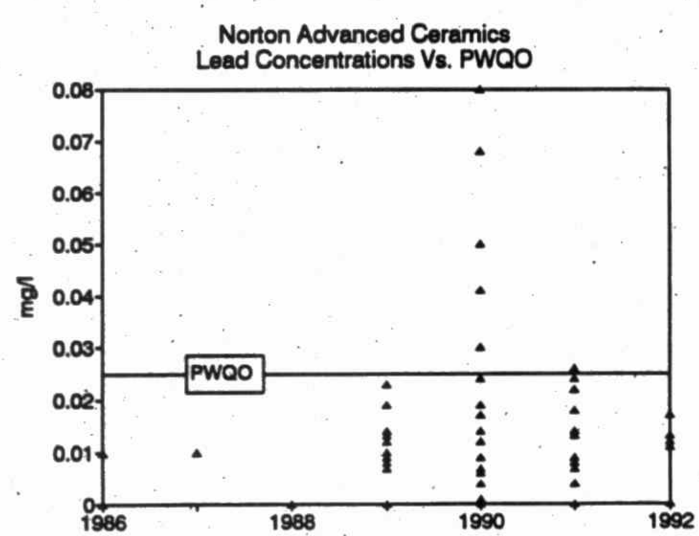


Gould National Battery
Lead Concentrations Vs. PWQO

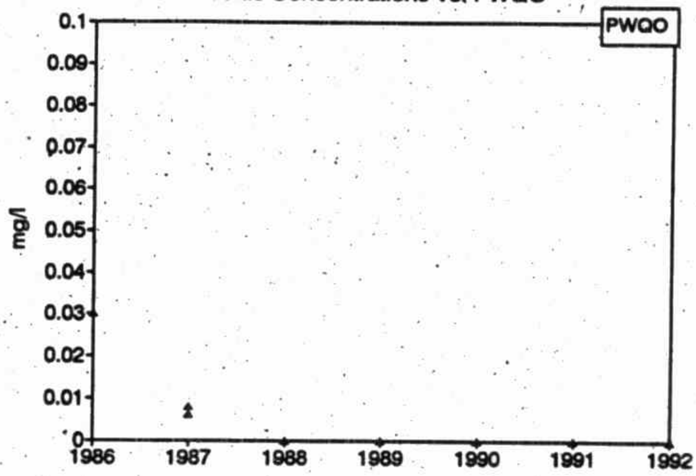



Norton Advanced Ceramics
Arsenic Concentrations Vs. PWQO
PWQO
mg/l
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1987
1988
1989
1990
1991
1992

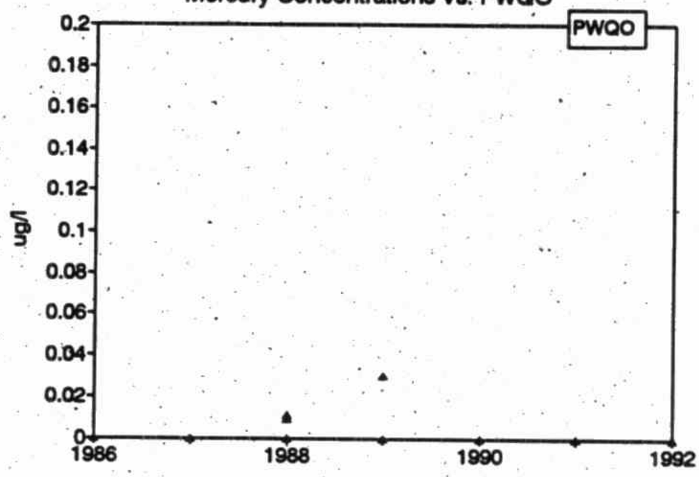

Norton Advanced Ceramics
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1986
1988
1990
1992


Norton Advanced Ceramics
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1988
1990
1992

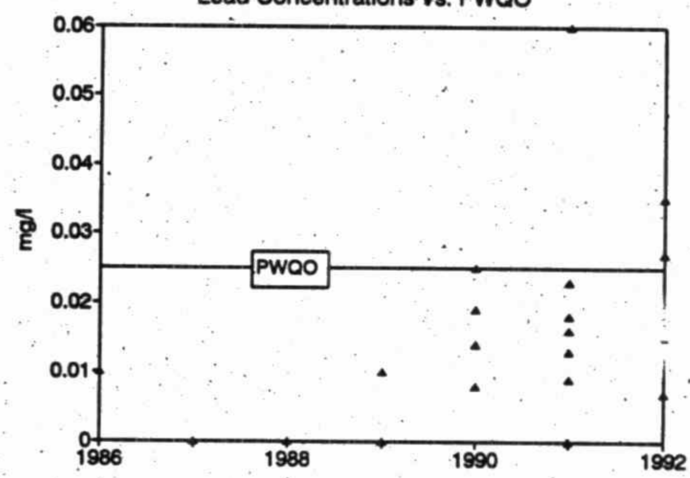
StelPipe - Welland Tubes
Arsenic Concentrations Vs. PWQO



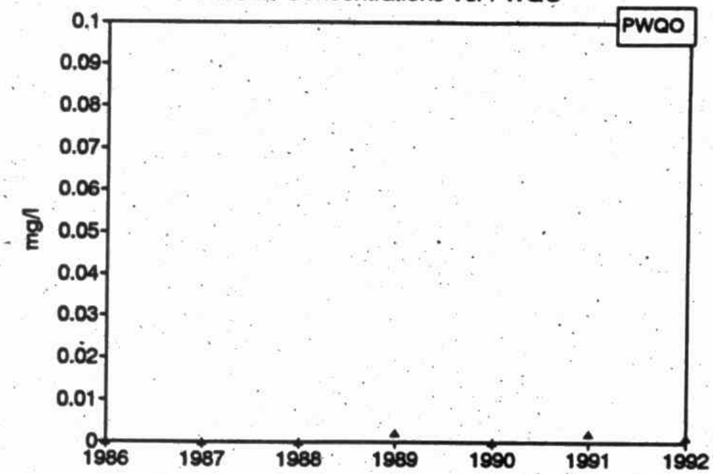
StelPipe Welland Tubes
Mercury Concentrations Vs. PWQO



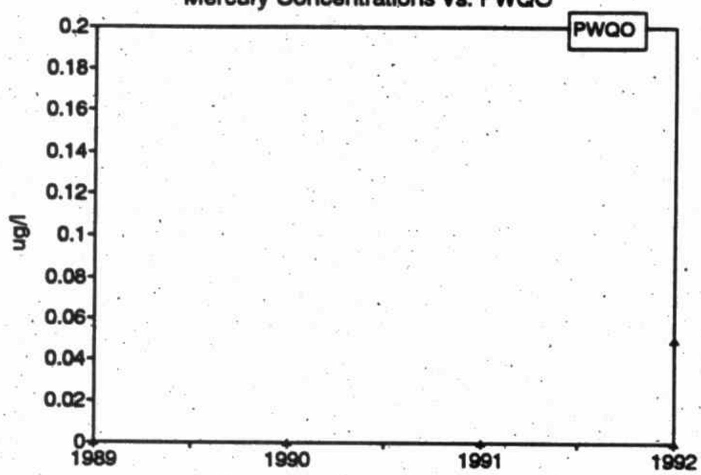
StelPipe Weland Tubes
Lead Concentrations Vs. PWQO



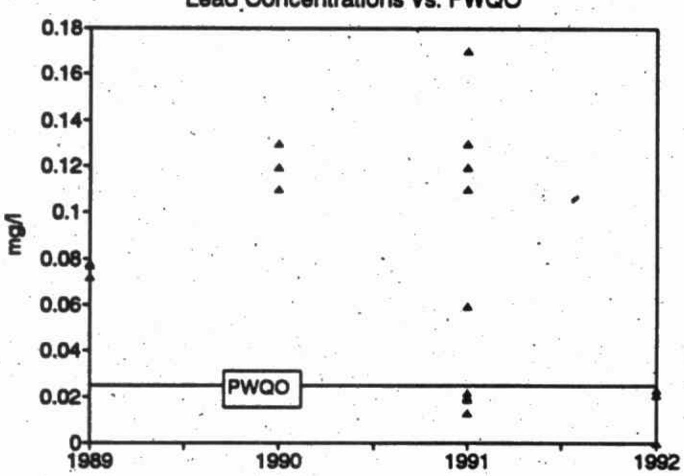
Washington Mills Ltd.
Arsenic Concentrations Vs. PWQO

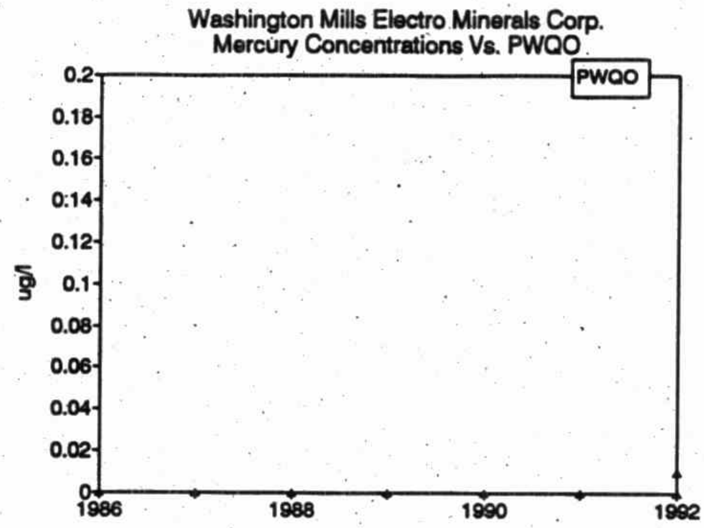


Washington Mills Ltd.
Mercury Concentrations Vs. PWQO

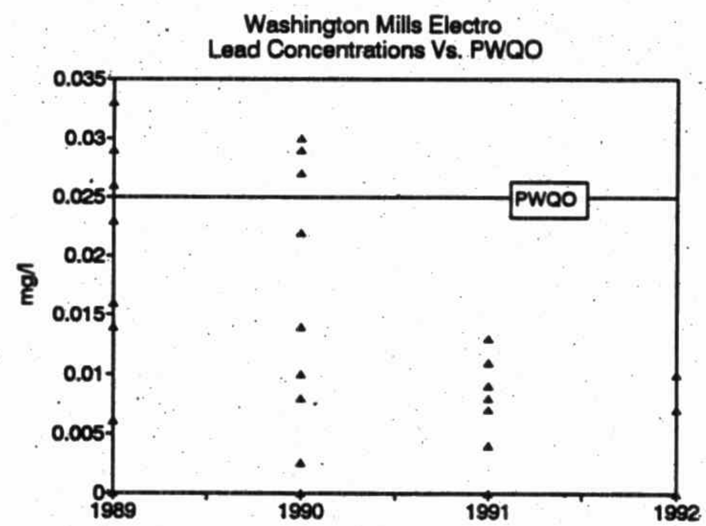


Washington Mills Ltd.
Lead Concentrations Vs. PWQO

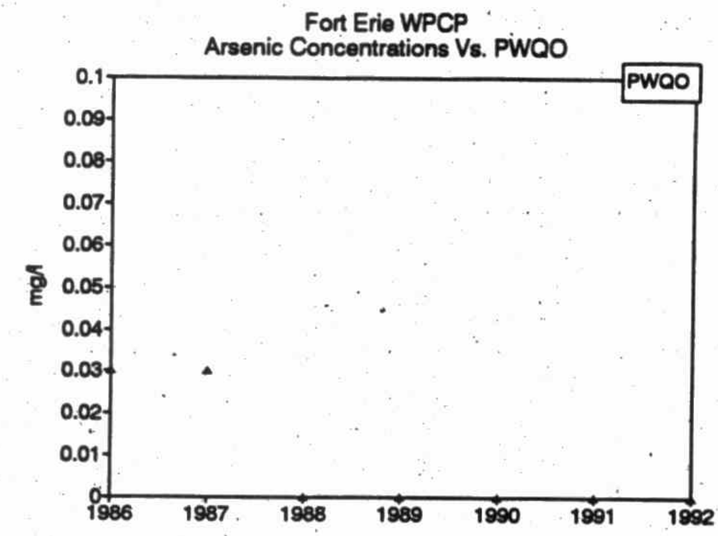


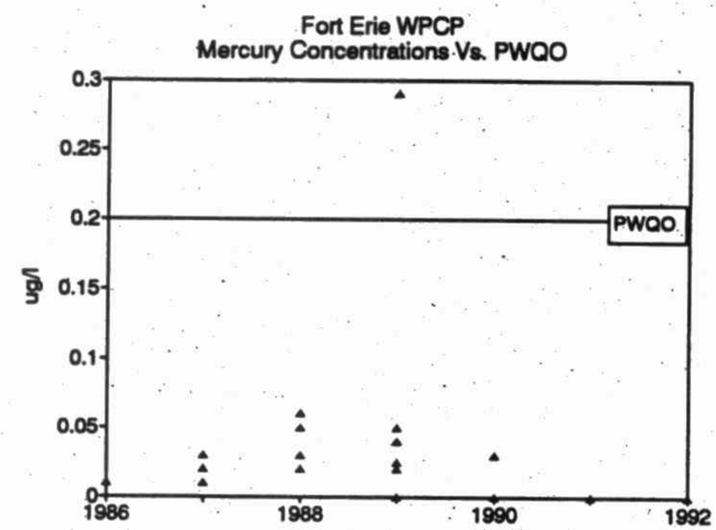


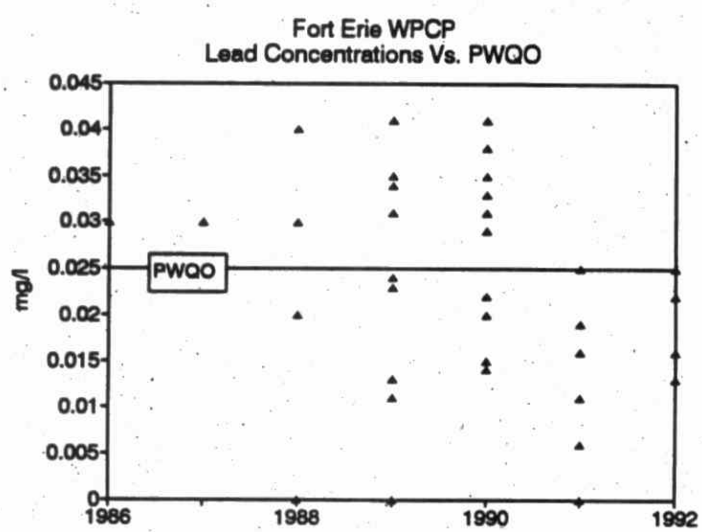
Washington Mills Electro Minerals Corp.
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1986
1988
1990
1992

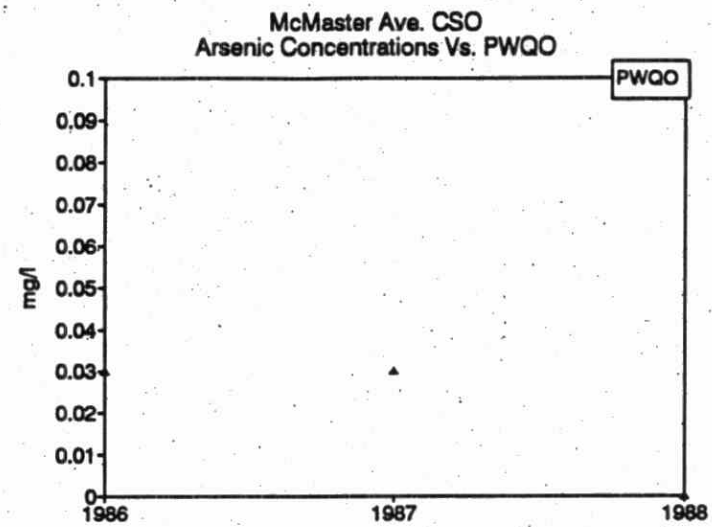


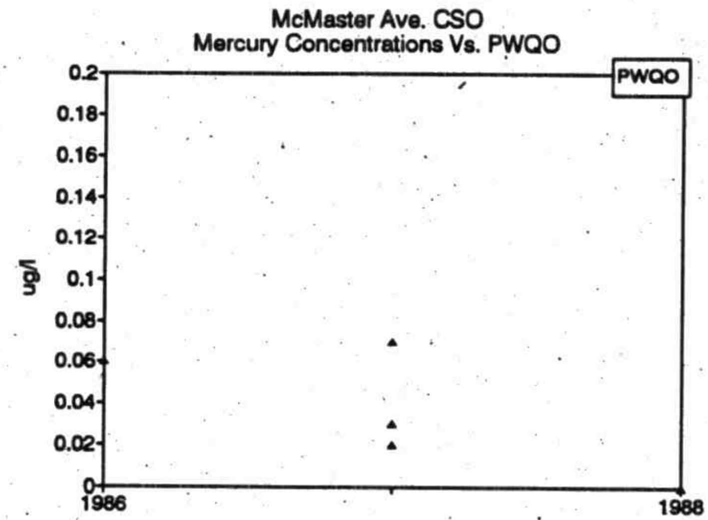
Washington Mills Electro
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
1989
1990
1991
1992

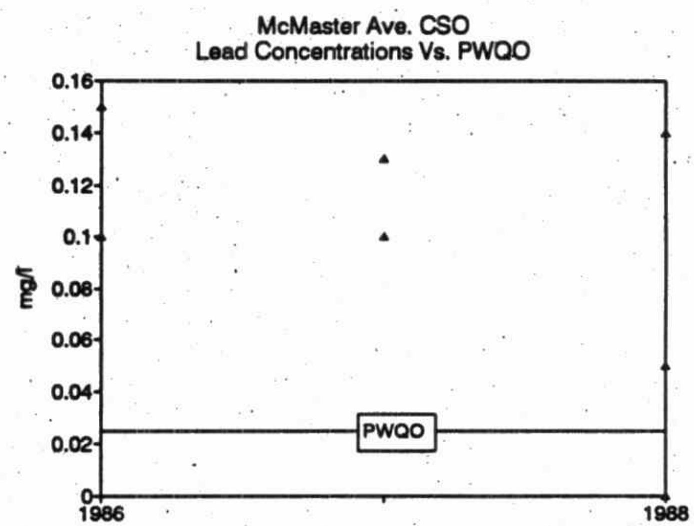

Fort Erie WPCP
Arsenic Concentrations Vs. PWQO
PWQO
mg/l
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1987
1988
1989
1990
1991
1992

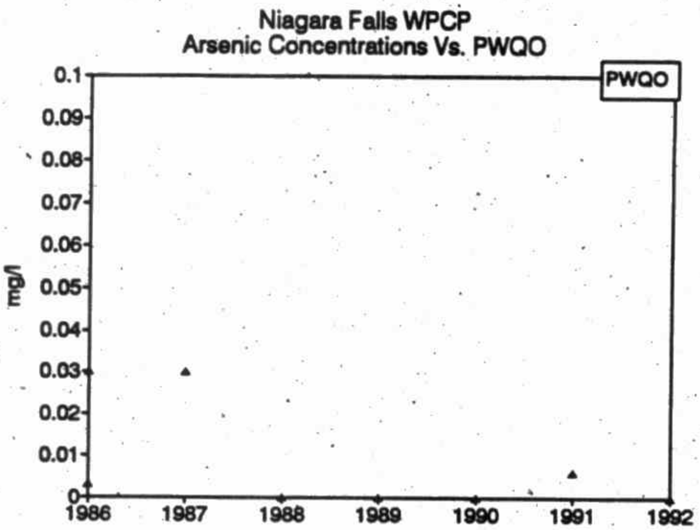

Fort Erie WPCP
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.3
0.25
0.2
0.15
0.1
0.05
0
1986
1988
1990
1992

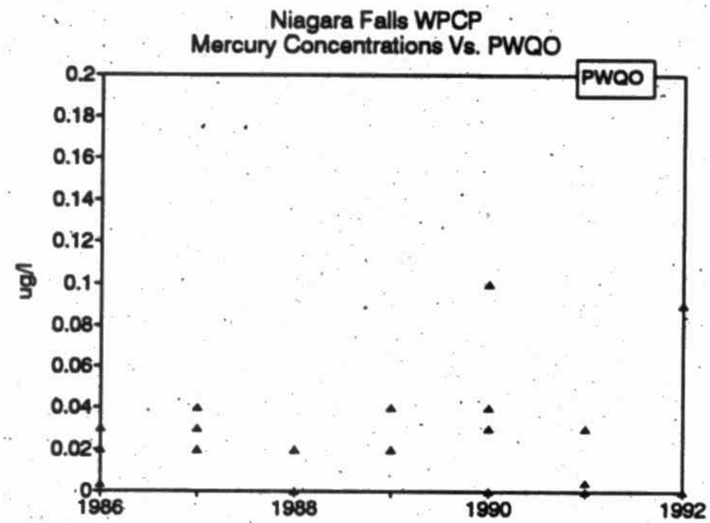

Fort Erie WPCP
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
1986
1988
1990
1992

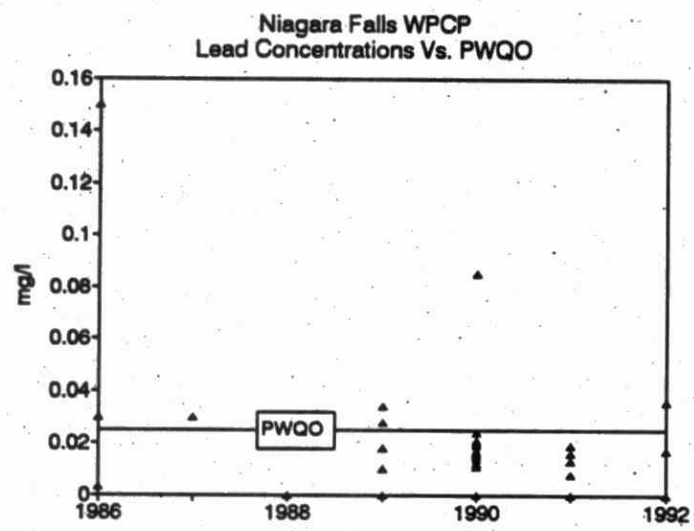

McMaster Ave. CSO
Arsenic Concentrations Vs. PWQO
PWQO
mg/l
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1987
1988


McMaster Ave. CSO
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1986
1988

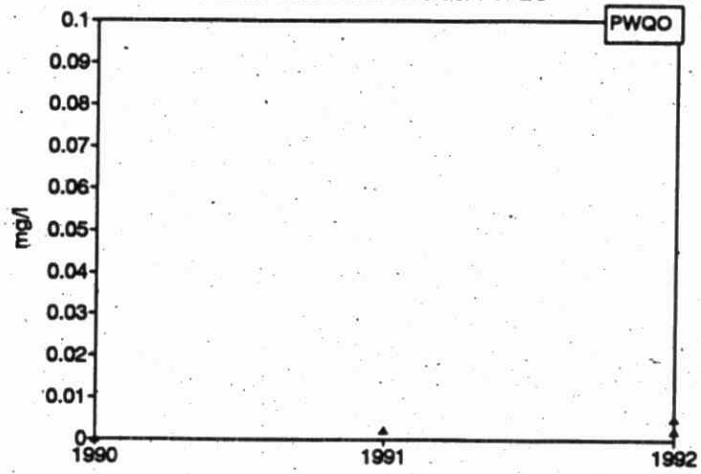

McMaster Ave. CSO
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1986
1988


Niagara Falls WPCP
Arsenic Concentrations Vs. PWQO
PWQO
mg/l
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1987
1988
1989
1990
1991
1992

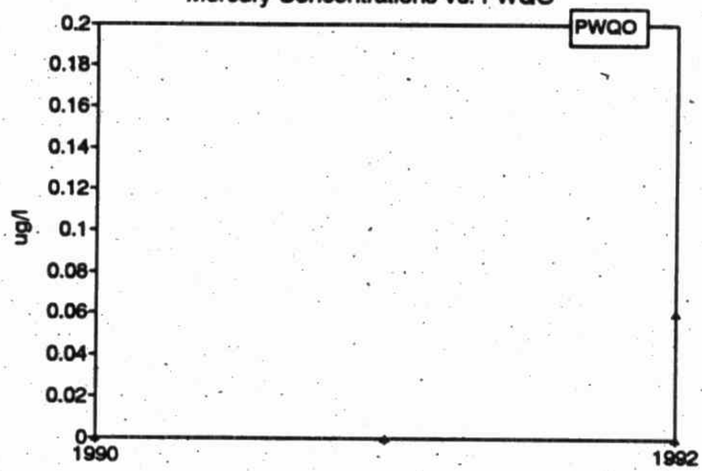

Niagara Falls WPCP
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1986
1988
1990
1992


Niagara Falls WPCP
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1986
1988
1990
1992

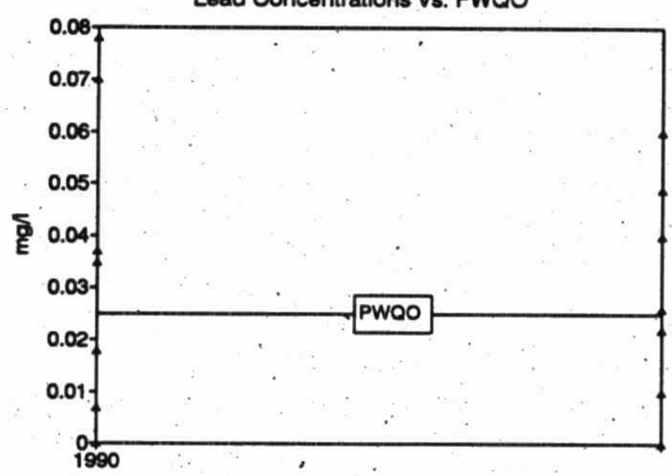
Port Robinson Lagoons
Arsenic Concentrations Vs. PWQO

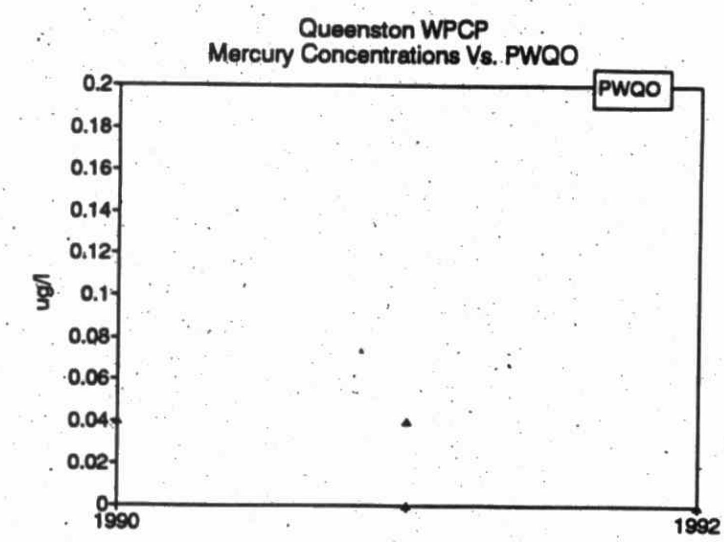


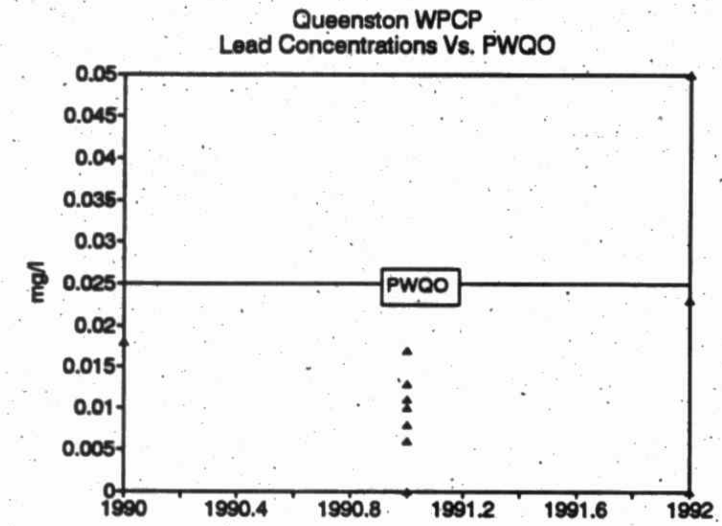
Port Robinson Lagoons
Mercury Concentrations Vs. PWQO

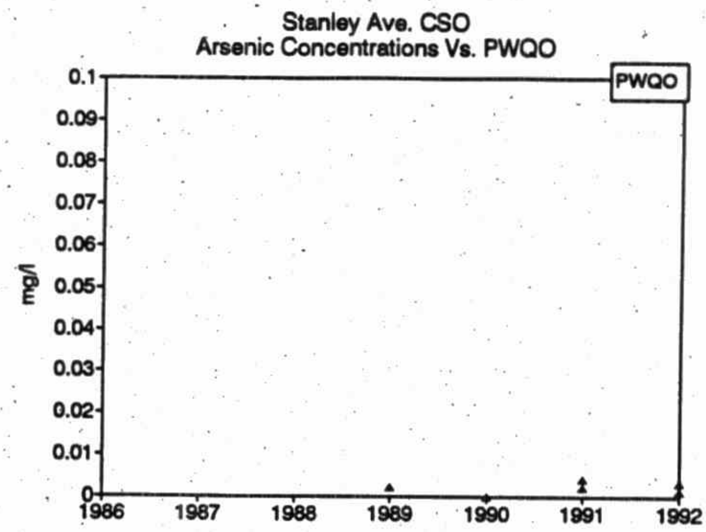


Port Robinson Lagoons
Lead Concentrations Vs. PWQO

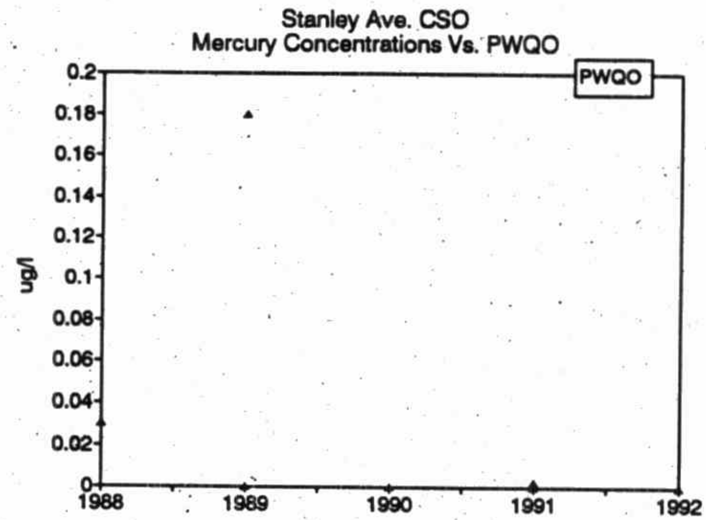



Queenston WPCP
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1990
1992

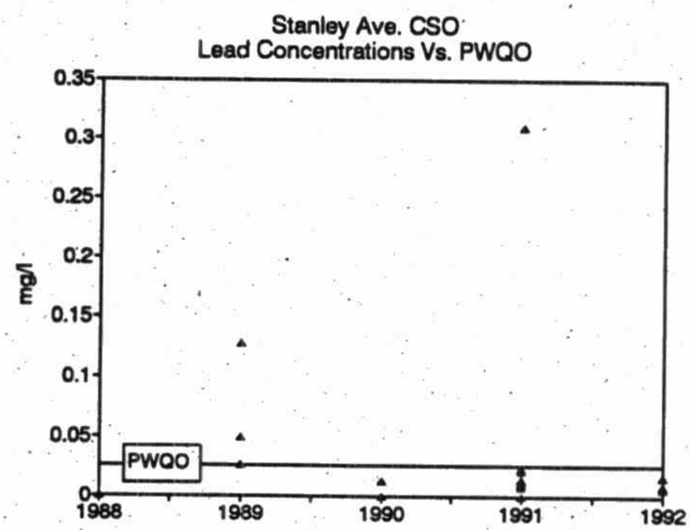

Queenston WPCP
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
1990
1990.4
1990.8
1991.2
1991.6
1992



Stanley Ave. CSO
Arsenic Concentrations Vs. PWQO
PWQO
mg/l
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1987
1988
1989
1990
1991
1992

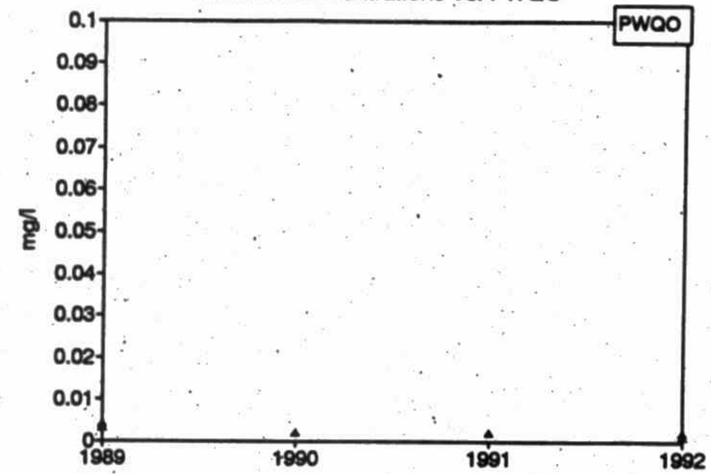


Stanley Ave. CSO
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1988
1989
1990
1991
1992

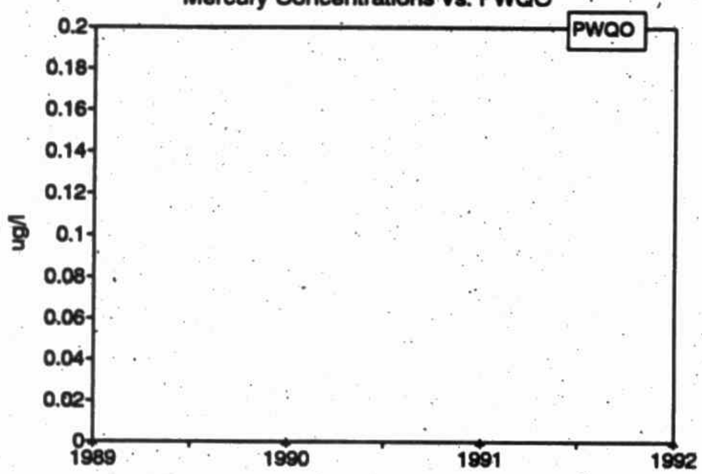


Stanley Ave. CSO
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1988
1989
1990
1991
1992

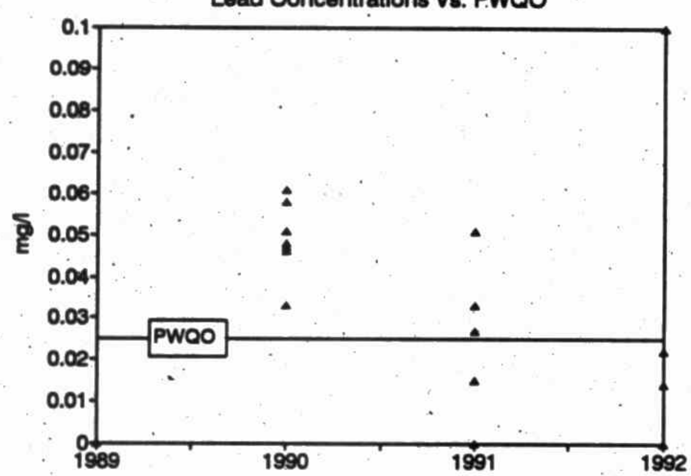
Stevensville-Douglastown Lagoons
Arsenic Concentrations Vs. PWQO

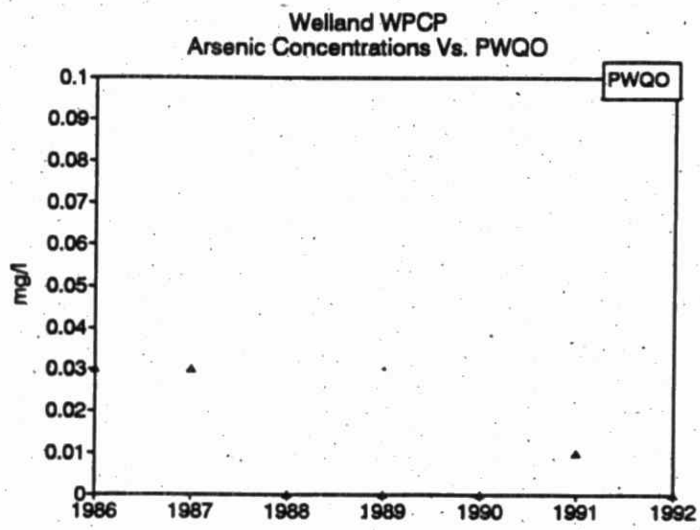


Stevensville-Douglastown Lagoons
Mercury Concentrations Vs. PWQO

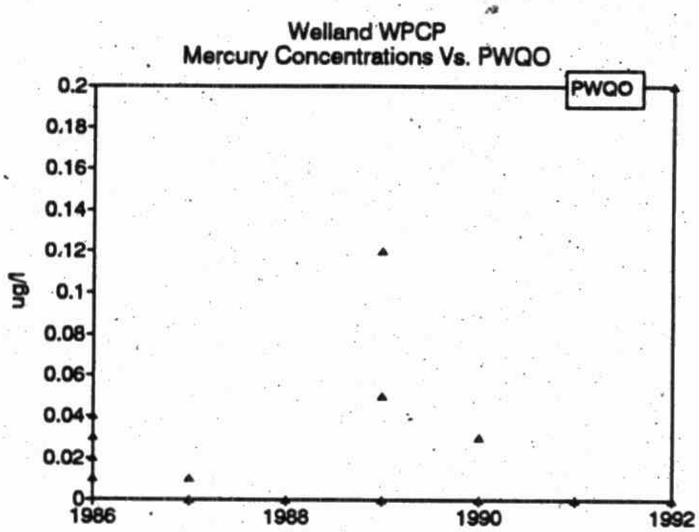


Stevensville-Douglastown Lagoons
Lead Concentrations Vs. PWQO

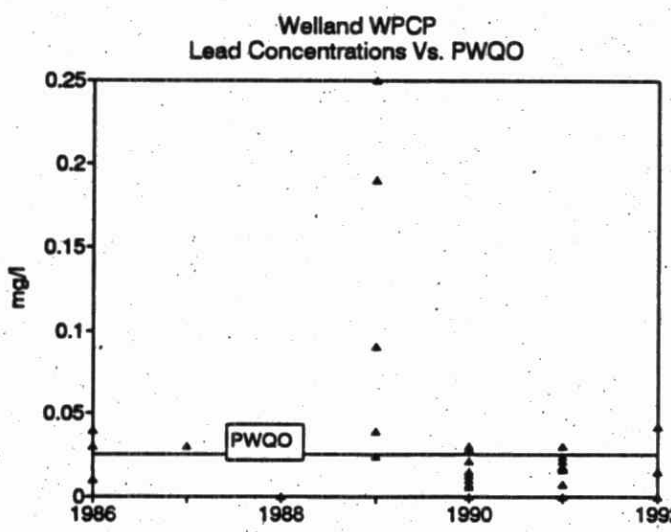




Welland WPCP
Arsenic Concentrations Vs. PWQO
PWQO
mg/l
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1986
1987
1988
1989
1990
1991
1992



Welland WPCP
Mercury Concentrations Vs. PWQO
PWQO
ug/l
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1986
1988
1990
1992



Welland WPCP
Lead Concentrations Vs. PWQO
PWQO
mg/l
0.25
0.2
0.15
0.1
0.05
0
1986
1988
1990
1992

APPENDIX D

TOTAL LOADINGS OF THE 18 CHEMICALS OF CONCERN MISA MONITORING DATA

TABLE 25: ATLAS SPECIALTY STEELS – YEARLY TOTAL LOADINGS
MISA MONITORING DATA

	1989 LOADING Kg/day	DETECTS/ SAMPLES	1990 LOADING Kg/day	DETECTS/ SAMPLES	1991 LOADING Kg/day	DETECTS/ SAMPLES	1992 LOADING Kg/day	DETECTS/ SAMPLES
Arsenic	0.019	2/2	0.012	3/3	0	0/1	0	0/2
Mercury	not analyzed		not analyzed		0	0/1	0	0/2
Lead	0.158	5/5	0.406	7/7	0.17	1/1	0.27	2/2
Benz(a)anthracene	0.004	4/4	0.006	7/7	0	0/1	0	0/2
Benzo(a)pyrene	0.008	4/4	0.011	7/7	0	0/1	0	0/2
Benzo(b)fluoranthene	0.01	4/4	0.013	7/7	0	0/1	0	0/2
Benzo(k)fluoranthene	0.01	4/4	0.013	7/7	0	0/1	0	0/2
Chrysene	0.004	4/4	0.006	7/7	0	0/1	0	0/2
Tetrachloroethylene	0.01	5/5	0.012	6/6	0	0/1	0	0/2
Octachlorostyrene	0	0/4	0	0/7	0	0/1	0	0/2
Hexachlorobenzene	0	0/4	0.006	7/7	0	0/1	0	0/2
PCBs	0	0/1	0.001	0/1	0	0/1	0	0/2
Mirex	not analyzed		not analyzed		0	0/1	0	0/2
Alpha Chlordane	0.031	1/1	not analyzed		0	0/1	0	0/2
Gamma Chlordane	0.031	1/1	not analyzed		0	0/1	0	0/2
Oxychlordane	0.031	1/1	not analyzed		0	0/1	0	0/2
Dieldrin	0.062	1/1	not analyzed		0	0/1	0	0/2
Toxaphene	not analyzed		not analyzed		0	0/1	0	0/2
DDT–p	0.077	1/1	not analyzed		0	0/1	0	0/2
DDT–o	0.077	1/1	not analyzed		0	0/1	0	0/2
2,3,7,8 Dioxin	0	0/1	0	0/1	not analyzed		not analyzed	
TOTAL	0.532		0.486		0.17		0.27	

DETECTS/SAMPLES – The number of times a parameter was detected/
Number of samples taken for that Parameter

TABLE 26: CYANAMID – NIAGARA PLANT – YEARLY LOADINGS
MISA MONITORING DATA

	1989 NET LOADING Kg/day	DETECTS/ SAMPLES	1990 NET LOADING Kg/day	DETECTS/ SAMPLES	1991 LOADING Kg/day	DETECTS/ SAMPLES	1992 LOADING Kg/day	DETECTS/ SAMPLES
Arsenic	0	0/1	0	0/8	0	0/3		
Mercury	0.00165	1/1	0.000024	8/8	0	0/3	Facility mothballed, no effluent discharged.	
Lead	0	0/1	0	0/8	0.0048	1/3		
Benz(a)anthracene	0	0/1	0	0/7	0	0/3		
Benzo(a)pyrene	0	0/1	0	0/7	0	0/3		
Benzo(b)fluoranthene	0	0/1	0	0/7	0	0/3		
Benzo(k)fluoranthene	0	0/1	0	0/7	0	0/3		
Chrysene	0	0/1	0	0/7	0	0/3		
Tetrachloroethylene	0	0/1	0	0/1	0	0/3		
Octachlorostyrene	0	0/1	0	0/1	0	0/3		
Hexachlorobenzene	0	0/1	0	0/1	0	0/3		
PCBs	0	0/1	0	0/2	0	0/3		
Mirex	0	0/1	not analyzed		0	0/3		
Alpha Chlordane	0	0/1	not analyzed		0	0/3		
Gamma Chlordane	0	0/1	not analyzed		0	0/3		
Oxychlordane	0	0/1	not analyzed		0	0/3		
Dieldrin	0	0/1	not analyzed		0	0/3		
Toxaphene	not analyzed		not analyzed		0	0/3		
DDT–p	0	0/1	not analyzed		0	0/3		
DDT–o	0	0/1	not analyzed		0	0/3		
2,3,7,8 Dioxin	0	0/1	0	0/1	not analyzed			
TOTAL	0.00165		0.000024		0.0048		0	

DETECTS/SAMPLES – The number of times a parameter was detected/
Number of samples taken for that Parameter

TABLE 27: CYANAMID – WELLAND PLANT – YEARLY LOADINGS
MISA MONITORING DATA

	1989 TOTAL LOADING Kg/day	DETECTS/ SAMPLES	1990 NET LOADING Kg/day	DETECTS/ SAMPLES	1991 TOTAL LOADING Kg/day	DETECTS/ SAMPLES	1992 TOTAL LOADING Kg/day	DETECTS/ SAMPLES
Arsenic	0.07	1/1	0.0027	8/8	0.035	1/1	0.067	2/3
Mercury	0	1/1	0	0/8	0	0/1	0.001	1/3
Lead	0.28	4/4	0	0/8	0.11	1/1	0.58	2/3
Benz(a)anthracene	not analyzed		0	0/2	0	0/1	0	0/3
Benzo(a)pyrene	not analyzed		0	0/2	0	0/1	0	0/3
Benzo(b)fluoranthene	not analyzed		0	0/2	0	0/1	0	0/3
Benzo(k)fluoranthene	not analyzed		0	0/2	0	0/1	0	0/3
Chrysene	not analyzed		0	0/2	0	0/1	0	0/4
Tetrachloroethylene	0.001	1/1	0	0/8	0	0/1	0	0/3
Octachlorostyrene	not analyzed		0	0/2	0	0/1	0	0/3
Hexachlorobenzene	not analyzed		0	0/2	0	0/1	0	0/3
PCBs	not analyzed		0	0/2	0	0/1	0	0/3
Mirex	not analyzed		not analyzed		0	0/1	0	0/3
Alpha Chlordane	not analyzed		not analyzed		0	0/1	0	0/3
Gamma Chlordane	not analyzed		not analyzed		0	0/1	0	0/3
Oxychlordane	not analyzed		not analyzed		0	0/1	0	0/3
Dieldrin	not analyzed		not analyzed		0	0/1	0	0/3
Toxaphene	not analyzed		not analyzed		0	0/1	0	0/3
DDT–p	not analyzed		not analyzed		0	0/1	0	0/3
DDT–o	not analyzed		not analyzed		0	0/1	0	0/3
2,3,7,8 Dioxin	not analyzed		not analyzed		not analyzed		0	0/2
TOTAL	0.351		0.0027		0.145		0.648	

DETECTS/SAMPLES – The number of times a parameter was detected/
Number of samples taken for that Parameter

TABLE 28: WASHINGTON MILLS LTD. – YEARLY TOTAL LOADINGS
MISA MONITORING DATA

	1989 LOADING Kg/day	NO. OF SAMPLES	1990 LOADING Kg/day	NO. OF SAMPLES	1991 LOADING Kg/day	DETECTS/ SAMPLES	1992 LOADING Kg/day	DETECTS/ SAMPLES
Arsenic	0.006	0/1	0.007	1/1	0.002	1/2	0.002	1/2
Mercury	0	0/1	0	0/1	0	0/2	0	0/2
Lead	0.022	4/4	0.02	8/8	0.035	2/2	0.022	2/2
Benz(a)anthracene	0	0/1	0	0/1	0	0/2	0	0/2
Benzo(a)pyrene	0.001	0/1	0.001	1/1	0	0/2	0	0/2
Benzo(b)fluoranthene	0.001	0/1	0.001	1/1	0	0/2	0	0/2
Benzo(k)fluoranthene	0.001	0/1	0.001	1/1	0	0/2	0	0/2
Chrysene	0.001	0/1	0.001	1/1	0	0/2	0	0/2
Tetrachloroethylene	0	0/1	0	0/1	0	0/2	0	0/2
Octachlorostyrene	0	0/1	0	0/1	0	0/2	0	0/2
Hexachlorobenzene	0	0/1	0	0/1	0	0/2	0	0/2
PCBs	0	0/1	0	0/1	0	0/2	0	0/2
Mirex	not analyzed		not analyzed		0	0/2	0	0/2
Alpha Chlordane	not analyzed		not analyzed		0	0/2	0	0/2
Gamma Chlordane	not analyzed		not analyzed		0	0/2	0	0/2
Oxychlordane	not analyzed		not analyzed		0	0/2	0	0/2
Dieldrin	not analyzed		not analyzed		0	0/2	0	0/2
Toxaphene	not analyzed		not analyzed		0	0/2	0	0/2
DDT–p	not analyzed		not analyzed		0	0/2	0	0/2
DDT–o	not analyzed		not analyzed		0	0/2	0	0/2
2,3,7,8 Dioxin	0	0/1	0	0/1	not analyzed		not analyzed	
TOTAL	0.032		0.031		0.037		0.024	

DETECTS/SAMPLES – The number of times a parameter was detected/
Number of samples taken for that Parameter

TABLE 29: WASHINGTON MILLS ELECTRO – YEARLY TOTAL LOADINGS
MISA MONITORING DATA

	1989 LOADING Kg/day	NO. OF SAMPLES	1990 LOADING Kg/day	NO. OF SAMPLES	1991 LOADING Kg/day	DETECTS/ SAMPLES	1992 LOADING Kg/day	DETECTS/ SAMPLES
Arsenic	0.06	2/2	0.052	2/2	0	0/2	0.01	1/2
Mercury	0	0/2	0	0/2	0	0/2	0	0/2
Lead	0.176	8/8	0.182	15/15	0.071	1/2	0.21	0/2
Benz(a)anthracene	0.004	2/2	0.003	2/2	0	0/2	0	0/2
Benzo(a)pyrene	0.004	2/2	0.003	2/2	0	0/2	0	0/2
Benzo(b)fluoranthene	0.01	2/2	0.009	2/2	0	0/2	0	0/2
Benzo(k)fluoranthene	0.008	2/2	0.007	2/2	0	0/2	0	0/2
Chrysene	0.008	2/2	0.007	2/2	0	0/2	0	0/2
Tetrachloroethylene	0.008	2/2	0.005	2/2	0	0/2	0	0/2
Octachlorostyrene	0	0/2	0	0/2	0	0/2	0	0/2
Hexachlorobenzene	0	0/2	0	0/2	0	0/2	0	0/2
PCBs	0	0/2	0.001	1/2	0	0/2	0	0/2
Mirex	not analyzed		not analyzed		0	0/2	0	0/2
Alpha Chlordane	not analyzed		not analyzed		0	0/2	0	0/2
Gamma Chlordane	not analyzed		not analyzed		0	0/2	0	0/2
Oxychlordane	not analyzed		not analyzed		0	0/2	0	0/2
Dieldrin	not analyzed		not analyzed		0	0/2	0	0/2
Toxaphene	not analyzed		not analyzed		0	0/2	0	0/2
DDT–p	not analyzed		not analyzed		0	0/2	0	0/2
DDT–o	not analyzed		not analyzed		0	0/2	0	0/2
2,3,7,8 Dioxin	0	0/2	0	0/2	not analyzed		not analyzed	
TOTAL	0.278		0.269		0.071		0.22	

DETECTS/SAMPLES – The number of times a parameter was detected/
Number of samples taken for that Parameter

TABLE 30: NORTON ADVANCED CERAMICS – YEARLY NET LOADINGS
MISA MONITORING DATA

	1989 LOADING Kg/day	DETECTS/ SAMPLES	1990 LOADING Kg/day	DETECTS/ SAMPLES	1991 LOADING Kg/day	DETECTS/ SAMPLES	1992 LOADING Kg/day	DETECTS/ SAMPLES
Arsenic	not analyzed		0.018	6/6	0.002	1/5	0.001	1/4
Mercury	0	4/4	0	0/10	0	0/5	0	0/4
Lead	0	1/1	0.083	20/20	0.046	2/5	0.095	4/4
Benz(a)anthracene	not analyzed		0.001	6/6	0	0/5	0	0/4
Benzo(a)pyrene	not analyzed		0.004	6/6	0	0/5	0	0/4
Benzo(b)fluoranthene	not analyzed		0.005	6/6	0	0/5	0	0/4
Benzo(k)fluoranthene	not analyzed		0.005	6/6	0	0/5	0	0/4
Chrysene	not analyzed		0.002	6/6	0	0/5	0	0/4
Tetrachloroethylene	not analyzed		0.014	6/6	0	0/5	0	0/4
Octachlorostyrene	not analyzed		0	6/6	0	0/5	0	0/4
Hexachlorobenzene	not analyzed		0.001	6/6	0	0/5	0	0/4
PCBs	not analyzed		0	6/6	0	0/5	0	0/4
Mirex	not analyzed		not analyzed		0	0/5	0	0/4
Alpha Chlordane	not analyzed		not analyzed		0	0/5	0	0/4
Gamma Chlordane	not analyzed		not analyzed		0	0/5	0	0/4
Oxychlordane	not analyzed		not analyzed		0	0/5	0	0/4
Dieldrin	not analyzed		not analyzed		0	0/5	0	0/4
Toxaphene	not analyzed		not analyzed		0	0/5	0	0/4
DDT–p	not analyzed		not analyzed		0	0/5	0	0/4
DDT–o	not analyzed		not analyzed		0	0/5	0	0/4
2,3,7,8 Dioxin	not analyzed		not analyzed		0	0/5	not analyzed	
TOTAL	0		0.133		0.048		0.096	

DETECTS/SAMPLES – The number of times a parameter was detected/
Number of samples taken for that Parameter

TABLE 31: CANADIANOXY CHEMICALS – YEARLY TOTAL LOADINGS
MISA MONITORING DATA

	1989 LOADING Kg/day	1989 DETECTS/ SAMPLES	1990 LOADING Kg/day	1990 DETECTS/ SAMPLES	1991 LOADING Kg/day	1991 DETECTS/ SAMPLES	1992 LOADING Kg/day	1992 DETECTS/ SAMPLES
Arsenic	not analyzed		not analyzed		0	0/1	0	0/1
Mercury	not analyzed		not analyzed		0	0/1	0	0/1
Lead	0.003	6/6	0.001	6/6	0	0/1	0	0/1
Benz(a)anthracene	not analyzed		not analyzed		0	0/1	0	0/1
Benzo(a)pyrene	not analyzed		not analyzed		0	0/1	0	0/1
Benzo(b)fluoranthene	not analyzed		not analyzed		0	0/1	0	0/1
Benzo(k)fluoranthene	not analyzed		not analyzed		0	0/1	0	0/1
Chrysene	not analyzed		not analyzed		0	0/1	0	0/1
Tetrachloroethylene	not analyzed		not analyzed		0	0/1	0	0/1
Octachlorostyrene	not analyzed		not analyzed		0	0/1	0	0/1
Hexachlorobenzene	not analyzed		not analyzed		0	0/1	0	0/1
PCBs	not analyzed		not analyzed		0	0/1	0	0/1
Mirex	not analyzed		not analyzed		0	0/1	0	0/1
Alpha Chlordane	not analyzed		not analyzed		0	0/1	0	0/1
Gamma Chlordane	not analyzed		not analyzed		0	0/1	0	0/1
Oxychlordane	not analyzed		not analyzed		0	0/1	0	0/1
Dieldrin	not analyzed		not analyzed		0	0/1	0	0/1
Toxaphene	not analyzed		not analyzed		0	0/1	0	0/1
DDT–p	not analyzed		not analyzed		0	0/1	0	0/1
DDT–o	not analyzed		not analyzed		0	0/1	0	0/1
2,3,7,8 Dioxin	not analyzed		not analyzed		0	0/1	0	0/1
TOTAL	0.003		0.001		0		0	

DETECTS/SAMPLES – The number of times a parameter was detected/
Number of samples taken for that Parameter

TABLE 32: GEON CANADA – YEARLY TOTAL LOADINGS
MISA MONITORING DATA

	1989		1990		1991	1992	
	LOADING Kg/day	DETECTS/ SAMPLES	LOADING Kg/day	DETECTS/ SAMPLES	LOADING Kg/day	LOADING Kg/day	DETECTS/ SAMPLES
Arsenic	0.001	1/1	not analyzed		not analyzed	0	0/3
Mercury	0	0/1	not analyzed		not analyzed	0.00007	2/3
Lead	0.004	1/1	not analyzed		not analyzed	0.023	2/3
Benz(a)anthracene	0.003	1/1	0.001	1/1	not analyzed	0.004	1/3
Benzo(a)pyrene	0.003	1/1	0.001	1/1	not analyzed	0	0/3
Benzo(b)fluoranthene	0.001	1/1	0.001	1/1	not analyzed	0	0/3
Benzo(k)fluoranthene	0.001	1/1	0.001	1/1	not analyzed	0	0/3
Chrysene	0.001	1/1	0.001	1/1	not analyzed	0.025	1/3
Tetrachloroethylene	0.001	1/1	0.002	1/1	not analyzed	0	0/3
Octachlorostyrene	0	0/1	0	0/1	not analyzed	0	0/3
Hexachlorobenzene	0	0/1	0	0/1	not analyzed	0	0/3
PCBs	0.029	1/1	0.062	1/1	not analyzed	0	0/3
Mirex	0.006	1/1	0.015	1/1	not analyzed	0	0/3
Alpha Chlordane	0.003	1/1	0.006	1/1	not analyzed	0	0/3
Gamma Chlordane	0.003	1/1	0.006	1/1	not analyzed	0	0/3
Oxychlordane	0.003	1/1	0.006	1/1	not analyzed	0	0/3
Dieldrin	0.006	1/1	0.012	1/1	not analyzed	0	0/3
Toxaphene	not analyzed		not analyzed		not analyzed	0	0/3
DDT–p	0.007	1/1	0.015	1/1	not analyzed	0	0/3
DDT–o	0.007	1/1	0.015	1/1	not analyzed	0	0/3
2,3,7,8 Dioxin	not analyzed		not analyzed		not analyzed	0	0/3
TOTAL	0.079		0.144		0	0.05207	

DETECTS/SAMPLES – The number of times a parameter was detected/
Number of samples taken for that Parameter

APPENDIX E

COMPARISON OF MISA AND NIAGARA RIVER IMPROVEMENT PROJECT DATA

Table 33: Comparison of MISA and Niagara River Improvement Project Data for 1992

	Atlas Steels		CanadianOxy Chemicals		Cyanamid Welland		Cyanamid Niagara	
	MISA	NRIP	MISA	NRIP	MISA	NRIP	MISA	NRIP
Arsenic	0	0	0	0	0.067	0.0255	Facility closed in 1992	
Mercury	0	0	0	0	0.001	0		
Lead	0.27	0.22	0	0.0008	0.58	0.61		

	Geon Canada		Norton		W. Mills Ltd.		W. Mills Electro	
	MISA	NRIP	MISA	NRIP	MISA	NRIP	MISA	NRIP
Arsenic	0	0	0.001	0	0.002	0.00025	0.01	0
Mercury	0.0007	0.00028	0	0.00002	0	0.000023	0	0
Lead	0.023	0.029	0.095	0.012	0.022	0.032	0.21	0.046

APPENDIX F

SAMPLING PRINCIPLES

APPENDIX F: SAMPLING PRINCIPLES

ANALYTICAL TEST GROUP	LABORATORY SAMPLE CONTAINER	LABORATORY CONTAINER PRE-TREATMENT	TEST SPECIFICS SAMPLING PRECAUTIONS	MIN. SAM. VOL.	PRESERVATION METHOD	MAX. STORAGE TIME (DAYS)
Total Metals	Sample containers and caps/liners must be composed only of one or more of the following materials: fluorocarbon resin, polyethylene terepthalate, glass, polystyrene, polypropylene, high or low density polyethylene. Metallic foil should not be used.	If pre-treatment necessary, soak overnight in a 5% solution of nitric acid (HNO_3), followed by several rinses in distilled water.	If sample is high(>5%) in hydrocarbons or organic solvents, use glass or fluorocarbon resin sample container only.	100 mL	Add nitric acid (HNO_3) (containing < 1 mg/L of all analyses) to lower pH to <2.	30
Hydrides	See Total Metals	See Total Metals	See Chemical Oxygen Demand	50 mL	Either none or as for metals, if to be analyzed from same sample.	30
Mercury	Glass or fluorocarbon resin, with plastic lined cap.	See Total Metals	No sample contact with metal except carbon steel or stainless steel.	200 mL	Add 1-2 mL nitric acid (HNO_3) per 250 mL sample followed by at least 0.5 mL potassium dichromate ($K_2Cr_2O_7$) solution to produce definite yellow colour.	7
Volatiles Halogenated	Sample containers and cap/liners in contact with the sample to be analyzed must be composed of only one or more of the following materials; fluorocarbon resin, glass, metallic foil (Note 1)	If pre-treatment necessary: Bottle Sequence of extensive washing/hot water detergent, water, distilled water. Bake at 300°C for 8h minimum. Cap: no pre-treatment.	Contact surfaces must be glass, fluorocarbon resin or stainless steel. See Mercury	25 mL	Only for samples containing residual chlorine. Prior to sampling add 80 mg sodium thiosulphate ($Na_2S_2O_3$) per 1 L. Keep in the dark.	7

APPENDIX F: SAMPLING PRINCIPLES

ANALYTICAL TEST GROUP	LABORATORY SAMPLE CONTAINER	LABORATORY CONTAINER PRE-TREATMENT	TEST SPECIFICS SAMPLING PRECAUTIONS	MIN. SAM. VOL.	PRESERVATION METHOD	MAX. STORAGE TIME (DAYS)
Extractables, Base Neutral	Amber glass or fluorocarbon resin with fluorocarbon resin lined cap.	If pre-treatment necessary Bottle: Sequence of extensive washing/hot water, detergent; water distilled water. Bake at 300°C for 8 h minimum or 3 rinses with pesticide grade or distilled in glass hexane and dichloromethane. Cap: no pre-treatment	Contact surfaces must be glass, fluorocarbon resin or stainless steel	800 mL	None	30
Extractables, Phenoxy Acid Herbicides	Amber glass with teflon or aluminum foil lined cap.	Generally no pre-treatment for new containers	See Extractables, Base Neutral	800 mL	None	30
Extractables, Organochlorine Pesticides	Amber glass with teflon or aluminum foil lined cap.	Generally no pre-treatment for new containers	See Extractables, Base Neutral	800 mL	None	30
Chlorinated DiBenzop-dioxins and Dibenzofurans	See Extractables, Base Neutral	See Extractables, Base Neutral	See Extractables, Base Neutral	4 L	None	30
Polychlorinated Biphenyls (PCBs)	Amber glass or fluorocarbon resin with foil or fluorocarbon resin lined screw cap. (NOTE1)	See Extractables, Base Neutral	See Extractables, Base Neutral	800 mL	None	30

APPENDIX G

ANALYTICAL PRINCIPLES

APPENDIX G: ANALYTICAL PRINCIPLES

ANALYTICAL TEST GROUP	PARAMETERS CONVENTIONAL AND METAL PARAMETERS	SAMPLE PREPARATION METHOD PRINCIPLES	INSTRUMENTAL MEASUREMENT METHOD PRINCIPLES	ALTERNATE INSTRUMENTAL MEASUREMENT METHOD PRINCIPLES	ANALYTICAL METHODS DETECTION LIMITS FOR STANDARDS IN REAGENT WATER ug/L
Volatile Organics	Tetrachloroethylene (Perchloroethylene)				1.1
	Hexachlorobenzene	Liquid/liquid extraction Neutral pH Cleanup if necessary	Gas liquid Chromatography Electron Capture Dual Capillary or Gas Chromatography Mass Spectroscopy (GC/MS) Capillary Column	N/A	0.01
	Octachlorostyrene	See Above	See Above	See Above	0.01
Base/Neutral Extractables	Benz(a)anthracene	Liquid/liquid extraction	Gas Chromatography/Mass Spectrometry (GC/MS) Capillary column	High Performance Liquid Chromatography Ultra Violet or Fluorescence Detection	0.5
	Benzo(a)pyrene	See Above	See Above	See Above	0.6
	Benzo(b)fluoranthene	See Above	See Above	See Above	0.7
	Benzo(k)fluoranthene	See Above	See Above	See Above	0.7
	Chrysene	See Above	See Above	See Above	0.3
	Extractables, Phenozy Acid Herbicides	See Above	See Above	See Above	0.01

APPENDIX G: ANALYTICAL PRINCIPLES

ANALYTICAL TEST GROUP	PARAMETERS CONVENTIONAL AND METAL PARAMETERS	SAMPLE PREPARATION METHOD PRINCIPLES	INSTRUMENTAL MEASUREMENT METHOD PRINCIPLES	ALTERNATE INSTRUMENTAL MEASUREMENT METHOD PRINCIPLES	ANALYTICAL METHOD DETECTION LIMITS FOR STANDARDS IN REAGENT WATER ug/L
Organchlorine Pesticides and PCBs	Polychlorinated Biphenyls (PCBs) (identify Arolors present & total concentration)	Liquid/liquid extraction Neutral pH Cleanup if necessary	Gas Liquid Chromatography/mass Spectroscopy (GS/MC) Capillary Column Report as PCB Aroclors	N/A	0.1
	Extractables, Organochlorine Pesticide	Same as PCB	N/A	N/A	0.01
	2,3,7,8 - Tetrachlorodibenzo-p-dioxin	Liquid/liquid extraction and cleanup or if TSS > 15mg/L filter sample, extract solids by Soxhlet using toluene, extract filtrate normally, combine both extracts	Gas Chromatography/Mass Spectroscopy (GC/MS) Capillary Column	N/A	0.000020

APPENDIX G: ANALYTICAL PRINCIPLES

ANALYTICAL TEST GROUP	PARAMETERS CONVENTIONAL AND METAL PARAMETERS	SAMPLE PREPARATION METHOD PRINCIPLES	INSTRUMENTAL MEASUREMENT METHOD PRINCIPLES	ALTERNATE INSTRUMENTAL MEASUREMENT METHOD PRINCIPLES	ANALYTICAL METHOD DETECTION LIMITS mg/L
Metals	Lead	Nitric evaporation or aura regia digestion	Atomic absorption spectrometry and/or Emission Spectometry - Industively Coupled Plasma (ICP) or Direct Current Argon Plasma Spectrometry (DCP)	Polarography via the method of standard addition in the presence of suitable electrolyte	0.03
Mercury	Mercury	Oxidative acid digestion	Cold vapour atomic absorption	N/A	0.001
Hydrides	Arsenic	Acid Digestion	Absorption	N/A	0.005

APPENDIX H

LIMITS OF QUANTIFICATION AND PWQOS FOR THE CHEMICALS OF CONCERN

APPENDIX H

LIMIT OF QUANTIFICATION FOR THE CHEMICALS OF CONCERN

Year	Arsenic mg/l	Mercury ug/l	Lead mg/l	Benz(a) Anthracene ug/l	Benzo(a) Pyrene ug/l
1986	0.001	0.01	0.01	1.0	1.0
1987	0.001	0.01	0.01	1.0	1.0
1988	0.001	0.01	0.01	2.0	2.0
1989	0.001	0.01	0.005	2.0	2.0
1990	0.001	0.02	0.005	0.2	0.2
1991	0.001	0.02	0.005	0.2	0.2
Year	Benzo(b) Fluoranthene ug/l	Benzo(k) Fluoranthene ug/l	Chrysene ug/l	Tetrachloro Ethylene ug/l	Octachloro Styrene ng/l
1986	1.0	1.0	1.0	1.0	NA
1987	1.0	1.0	1.0	1.0	NA
1988	5.0	5.0	1.0	1.0	NA
1989	1.0	1.0	1.0	0.5	NA
1990	0.2	0.2	0.2	0.5	1.0
1991	0.2	0.2	0.2	0.5	1.0
Year	Hexachloro Benzene ng/l	PCBs ng/l	Mirex ng/l	Alpha Chlordane ng/l	Gamma Chlordane ng/l
1986	1.0	20.0	5.0	2.0	2.0
1987	1.0	20.0	5.0	2.0	2.0
1988	1.0	20.0	5.0	2.0	2.0
1989	1.0	20.0	5.0	2.0	2.0
1990	1.0	20.0	5.0	2.0	2.0
1991	1.0	20.0	5.0	2.0	2.0
Year	Oxy Chlordane ng/l	Dieldrin ng/l	Toxaphene ng/l	O−DDT ng/l	P−DDT ng/l
1986	2.0	2.0	NA	5.0	5.0
1987	2.0	4.0	NA	5.0	5.0
1988	2.0	4.0	NA	5.0	5.0
1989	2.0	4.0	NA	5.0	5.0
1990	2.0	4.0	20.0	5.0	5.0
1991	2.0	4.0	20.0	5.0	5.0

NA = Not Analyzed

APPENDIX I

EFFECT OF MDLs ON LOADINGS

APPENDIX I

EFFECT OF MDLs ON LOADINGS (Kg/Day)

Method Detection Limit ug/l	Flow Rate (cubic meters/day) 2500	5000	25000	50000	100000
0.0005	0.00001	0.00003	0.00013	0.00250	0.00050
0.02	0.00005	0.00010	0.00500	0.00010	0.00200
0.05	0.00013	0.00025	0.00125	0.00250	0.00500
1.0	0.00250	0.00500	0.02500	0.05000	0.10000
2.0	0.00500	0.01000	0.05000	0.10000	0.20000
5.0	0.01250	0.02500	0.12500	0.25000	0.50000

APPENDIX J

ABATEMENT MEASURES AFFECTING LOADINGS

IMPROVEMENTS TO NIAGARA RIVER POINT SOURCE DISCHARGES - INDUSTRIAL

Facility	Treatment Improvement	Anticipated Result
Atlas Specialty Steel	Apr 1987 - Ceased discharge of pickling area overflow Oct 1991 - Demonstration project for removal of highly contaminated (metals) river sediments	Elimination of acid discharges. Will lead to full scale removal in 1993.
Geon Canada (B. F. Goodrich)	June 1990 - Adopted process for compounding PVC with plasticizes and stabilizers - Installation of distillation column - Stabilization Ponds replaced with equalization basins - Biological treatment increased to tertiary	Decrease in conventional and toxics discharges, particularly Vinyl Chloride monomer.
CanadianOxy	Feb 1989 - Contact cooling water from Resin Flaker Belt adapted to Closed Loop June 1993 - Cooling water closed - looped	Eliminated a phenol source. Eliminated a point source.
Cyanamid Niagara Falls	Mar 1992 - Plant taken out of operation	Elimination of this point source.
Cyanamid Welland	May 1987 - Nitric Acid, Ammonium Nitrate, and Calcium Phosphate stopped being produced - Installed equalization pond	Decrease in discharge loadings. Shock loadings equalized.

IMPROVEMENTS TO NIAGARA RIVER POINT SOURCE DISCHARGES - INDUSTRIAL

Facility	Treatment Improvement	Anticipated Result
Diner's Delight	1986 - Effluent now spray irrigated	No longer a point source.
Fleet Manufacturing	All process waste streams have been diverted to the municipal sewer system by 1988.	Virtual elimination of metals discharge.
Gould National Battery	1987 - Process wastewater redirected to municipal sewer system - Remediation carried out on lead contaminated soil along creek	No longer contributes lead to Niagara River.
Norton Advanced Ceramics Inc.	Nov 1991 - Contact cooling water changed to closed loop system	Elimination of a point source.

IMPROVEMENTS TO NIAGARA RIVER POINT SOURCE DISCHARGES - MUNICIPAL

Facility	Treatment Improvement	Anticipated Result
Fort Erie WPCP	1989 - Plant upgraded to Secondary Treatment - Treatment of significant stormwater flows	Improved effluent quality.
McMaster CSO	1989 - Diverted to Welland WPCP	Elimination of a point source discharge
Niagara Falls WPCP	1993 - Plans underway to provide full Secondary treatment	Improved Effluent quality.
Port Robinson Lagoons	1989 - Facility placed in operation	Elimination of real and potential private system discharges.
Queenston WPCP	1990 - Facility placed in operation	Elimination of real and potential private system discharges.
Welland WPCP	1989 - Plant upgraded to Tertiary treatment, or a "polishing" stage of filtration following the conventional secondary treatment process in order to further reduce the organic content of the wastewater.	Improved effluent quality.

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